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Proceedings
of the
World's Dairy Congress

Washington, D. C., October 2, 3
Philadelphia, Pa., October 4
Syracuse, N. Y., October 5, 6, 8, 9, 10
1923

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SESSION 1. OPENING SESSION.

Honorary chairman, H. H. Dean, professor of dairy husbandry, Ontario Agricultural College, Canada.

Chairman, Dr. H. E. Van Norman, president, World's Dairy Congress Association (Inc.).

Secretary, Sam H. Greene, secretary, California Dairy Council.

Memorial Continental Hall,
Washington, D. C., Tuesday, October 2, 1923—10 a. m.

The delegates and guests arose and applauded as President Van Norman of the congress and the Hon. Charles Evans Hughes, Secretary of State, came upon the platform.

(The Marine Band played the national anthem.)

Rev. Dr. James Shera Montgomery. Almighty God, Father of the races of men, lift upon us all the light of Thy holy countenance. May we ever esteem Thee to be the Source of every good and perfect gift.

Regard in great mercy and direct with divine wisdom the nations of the earth. Bless, Almighty God, the people of all lands and hasten the day when the troubled world will rest in peace and in Christian fraternity.

We ask Thy blessing upon our own dear country. Establish, more and more, the great fundamentals of our civilization. Direct and bless with great wisdom the President of these United States.

We ask the blessing of the common Heavenly Father of us all upon this assembly. Bless with divine mercy all families that are separated. Be there as well as here, and here as well as there.

Direct the deliberations of this body. Establish Thou the work of their hands, the work of their hands establish Thou it, through Jesus Christ, our Lord. Amen.

(President Van Norman was greeted with applause as he arose to open the meeting)

President Van Norman. It is indeed a happy day for those of us who have devoted most of our active adult life to the science, teaching, and business growing out of the rearing and care of that faithful servant of humanity, the dairy cow, when we can gather here in this beautiful hall in our Capital City as representatives of an international brotherhood, having a common interest in so humble a subject, and yet one so important. It is indeed a happy day when our interests have risen to the dignity which permits an invitation authorized by the Congress of the United States, extended in the name of the Chief Executive of our Nation, to all the nations of the world. It is a happy day that gives us the privilege of welcoming to our land the representatives of other lands by the Secretary of State of our Nation, our beloved Charles Evans Hughes.

(The delegates and guests arose and applauded.)

ADDRESS OF WELCOME.

Charles Evans Hughes, LL. D., Secretary of State, United States of America.

Mr. President, members of the congress, ladies and gentlemen: I esteem it a high privilege to have this opportunity of speaking a word of cordial greeting to the members of the congress and especially to those from other lands who have honored us by accepting our invitation to consider the interests of this basic industry with its vital relation to human welfare.

When I came in, Secretary Wallace welcomed me to his domain, and there may be in your minds just a thought of surprise at my being afforded the opportunity to speak this word of welcome. but perhaps you may reflect that diplomacy is the art of the distribution of the milk of human kindness. [Applause.] And it is most injurious when it is unwholesome. [Laughter and applause.]

I take pleasure in noting the fact, to which the president has called attention, that it was the people of the United States, acting through their representatives in the National Legislature, who, mindful not only of their domestic exigencies but intent upon international cooperation of a wise and fruitful character in this promising field, initiated the movement for this meeting.

Those of you who have come from other nations (I believe there are upward of 40 represented in this assembly) will find not only a most hearty welcome on the part of our people but, I believe, a most favorable atmosphere for this cooperative effort.

Washington, as you know, has been the scene of many important negotiations for the formulation of treaties, for the cementing of the bonds of international friendship, for the giving of assurances of peaceful adjustment. It was only two years ago that in this very hall there met a most important conference for the purpose of limiting naval armaments [applause] and of assuring peace by removing suspicion and distrust; but we can not fail to recognize that these aims, important as they are, constant and earnest as may be our endeavor to achieve them, are not the ultimate aims.

The ultimate aims lie beyond these. Peace itself is not a goal—not an ultimate goal, but an opportunity. Limitation of armament, assurances of good will, the maintenance of national security and of the conditions of national fellowship merely open the way to those endeavors by which we may seek to raise the standard of human living and make conditions better throughout the world for human beings.

That is our ultimate goal, and it is a great pleasure to come in contact with an endeavor of this sort, representing the kind of international cooperation which we could have on every hand if only we had the assurance of peace and amity which would enable us to work together for the common good of our peoples. [Applause.]

I like to think of one aspect of this gathering—its most important aspect. perhaps—and to emphasize it. That is of the sort of international cooperation which affords the opportunity for exchanging information, of the results of research, making known what has been accomplished by expert investigators, by producers and distributors.

In this way we not only have the opportunity for the pleasant intercourse of friends and those who have the unifying sentiment of common work and ideals, but we give to each other the benefit of what is being accomplished in these great experiment stations of human endeavor.

Our peoples are not formed simply in political units; our countries are great laboratories of human experimentation for the purpose of attaining ends which are necessary to all our peoples. What a misfortune it is that we are, to such an extent, held aloof in our separate activities, and that we can not more freely have these interchanges. It is in meetings like this that you have the clearing houses of expert information, that you are enabled to chart the ways of progress.

And, after all, what is the fundamental consideration? The fundamental consideration is public health—and you have in your work the most direct and vital relation to it. May I quote the words of the great philosopher, the great orator who illumined every subject that he touched, Cicero, who said, "Men approach most nearly to the gods in their efforts to protect human health."

So, I find in turning from the offices of diplomacy to welcome you to this most important and helpful effort, a peculiar sense of privilege. What an enormous amount of time we give to establishing and maintaining the machinery of Government, to the necessary activities of politics, in order that we can have at last a small margin of time and a little opportunity for the real efforts—to benefit human beings. [Applause.]

Here all that we have accomplished in the State Department, all that is being done in the Halls of Congress, all that is being done to give us a society well organized, stable, and prosperous, finds a focus in the intelligent effort directed immediately to human life, to health, giving us the benefit of experimentation, not only from an economic point of view but with respect to the wise and beneficial sort of public regulation which may safeguard life and health without interfering unnecessarily with individual initiative and opportunity.

I congratulate you upon this gathering; I have no doubt that out of it will come improved methods, higher knowledge; but in addition to all, and better than all, fresh inspiration for the best sort of international cooperation and for further meetings like these with a constantly increasing usefulness. [Applause.]

President Van Norman. There existed for some years before the war an International Dairy Federation. Since the plans for this congress were conceived, that organization has been reestablished. Its president, having expected to be here, unfortunately, at the last moment, found it impossible to come. He has therefore imposed upon the delegate from France the duty of presenting in his name his words of response to an address, the words of which he could not know, but the spirit of which he undoubtedly anticipated.

I have the pleasure of presenting to you now, Prof. Charles Porcher, of Lyons, France, who will present President Maenhaut's greeting.

(The delegates arose and applauded.)

RÉPONSE À L'ADRESSE DE BIENVENU.

Jules Maenhaut, président de la Fédération Internationale de Laiterie, Bruxelles.

Messieurs: Au moment de l'ouverture de ces solennelles assises, devant tant de hautes personnalités politiques, scientifiques et industrielles, venues de tous les pays du monde, permettez au président de la Fédération Internationale de Laiterie de vous apporter à tous un salut bien cordial et de vous exprimer les vœux ardents qu'il forme pour la bonne réussite du Congrès Universel de Laiterie.

J'eusse voulu, avec tous mes amis et collègues du Bureau Permanent de la Fédération, être au milieu de vous pour prendre part à vos intéressants travaux, pouvoir admirer tous les progrès que vous avez réalisés dans le domaine de la laiterie, visiter les stations et les laboratoires où vos savantes scrutent, avec un zèle infatigable et une conscience scrupuleuse toutes les questions de bactériologie, de chimie et de technique laitière, parcourir les divers services que vous avez créés pour venir en aide à toutes les industries du lait et étudier les règlements et les mesures hygiéniques que les pouvoirs publics ont décrétés pour empêcher les fraudes et ne vendre que des produits sains et purs.

J'eusse voulu aussi visiter vos établissements d'élevage si renommés et vos belles et grandes industries laitières.

Mais hélas! les malheurs des temps ne m'ont pas permis de donner corps à mon désir et ont aussi retenu bien des amis d'Europe qui eussent été heureux de vous marquer toute leur sympathie en venant participer à ce beau congrès, si grandiosement conçu par un de vos savants éminents, M. le Professeur H. E. Van Norman, Doyen de l'Université de Californie, à qui, au nom de la Fédération Internationale de Laiterie tout entière, je me plais à rendre hommage ainsi qu'à tous ses distingués collaborateurs. Dans ces journées solennelles, tous soyez-en assurés, nous serons de tout cœur avec vous.

En terminant, je tiens, au nom de la Fédération Internationale de Laiterie, à remercier tout spécialement le Gouvernement américain d'avoir bien voulu patronner le Congrès Universel de Laiterie. J'adresse mes plus respectueux hommages et mes plus chaleureuses félicitations au nouveau Président des États-Unis, son Excellence Mr. Coolidge. Puisse le temps qu'il passera à la Présidence de la Grande République américaine être une ère de prospérité et de bonheur pour lui-même et pour son peuple, travailleur modèle, qui fait l'admiration du monde entier! [Applause.]

President Van Norman. This is an international gathering. We have made arrangements so that each person who makes a contribution to the congress can be understood. We have tried to relieve the sessions of the maximum of that delay incident to repeating in different languages that which has been said.

There has been handed to each of you who has completed his registration a package like this [indicating]. The substance of everything which is to be said in a formal way, with some exceptions, has been abstracted and translated into English, French, German, and Spanish. We assume that you will bring with you to to-morrow's

sessions those abstracts relating to the subjects which are then to be discussed. We don't expect you to carry all of them all the time. That is why they were not bound together; but on the assumption that most of you have left them behind, I am going to ask our secretary of the morning to read in English Mr. Maenhaut's response which Professor Porcher has just given to us in French, and then I am going to assume that until otherwise informed most of us can understand what is going on or will have a friend near us who can explain.

We have Spanish, French, and German interpreters here who will make any necessary translations.

The secretary will now read a translation of Professor Maenhaut's greeting. [Applause.]

[Translation.]

RESPONSE TO ADDRESS OF WELCOME.

JULES MAENHAUT, president, International Dairy Federation, Brussels.

On the occasion of the opening of this august assembly, in the presence of so many notables from the ranks of politics, science, and industry who come here from all parts of the world, permit the president of the International Dairy Federation to send his cordial greeting and his sincere good wishes for the success of the World's Dairy Congress.

Like many of my friends and colleagues, I should like to be with you to participate in your interesting discussions, to marvel at all the progress that has been made in the field of dairying, to visit the experiment stations and the laboratories where your scientists investigate with indefatigable zeal and conscientious precision the various questions relative to the bacteriology, chemistry, and technology of the dairy industry. I should like to visit the numerous departments which you have created to aid all branches of the dairy industry, and study the laws and the sanitary ordinances which you have evolved to prevent adulteration and to assure the sale of pure and clean products. I should also like to visit your famous stock farms and your large and splendid dairy plants.

But alas, the unfavorable conditions of the times do not permit me to gratify my wish, and have kept many of us in Europe who would have been glad for the opportunity to show you their congenial interest by taking part in this congress, so grandly conceived by one of your eminent scholars, Mr. H. E. Van Norman, dean of the University of California, to whom, in the name of the entire International Dairy Federation, I am pleased to pay honor, as well as to all his distinguished colleagues. In these significant days, be assured that we are heartily with you.

In the name of the International Dairy Federation, I should like, in closing, to thank especially the Government of the United States for having so generously patronized the World's Dairy Congress. I tender my most respectful homage and my warmest felicitations to the new President of the United States, Mr. Coolidge. May the time which he spends in the Presidency of the United States be one of prosperity and happiness to himself and to his people, model workers who are the admiration of the entire world.

President VAN NORMAN. In this country of ours we have a great game called publicity. The men who write the stories for our papers always tell us they must have some names to talk about. The result is that some of us get a little more publicity than is deserved, but behind those in the limelight is a great body of those who work, unsung, unheard, and unknown.

On Saturday afternoon after 4 o'clock, five thousand times 212 sheets of these printed pages were delivered. Until 11 o'clock on Saturday night, 30 members of the Department of Agriculture worked to assemble those into the packages which have been handed to you. The next morning, Sunday, 40 more members of the department worked until late in the afternoon to complete that assembling so that you might have the envelopes which you now have. After that was done, the members of my staff worked until 11 o'clock Sunday night.

This congress could not have been possible, first, if the Congress of the United States had not authorized it; second, if the Department of Agriculture had not loaned, without charge, without question, the service of more men and women than I can tell you the names of. I think that right now is a good time for the American dairy industry to express its appreciation to the next speaker for the cooperation which he and his staff have extended to us in the development of the plans for this congress.

I have pleasure in presenting to you the leader of that great organization of which dairying is just a part, to say something to us on behalf of American agriculture. Secretary of Agriculture Henry C. Wallace.

(The delegates arose and applauded.)

WELCOME ON BEHALF OF THE DEPARTMENT OF AGRICULTURE.

Henry C. Wallace, LL. D., Secretary of United States Department of Agriculture.

I am sorry the minister who delivered the invocation has retired from the platform. My first duty is to ask him to absolve the members of the Department of Agriculture who worked on the Sabbath day. [Laughter.] I think, no doubt, he would gladly do that.

The Secretary of State, in the felicitous phrase of which he is such a master, has made you welcome on behalf of the Nation. Doctor Van Norman, no doubt, in his address (which he has postponed in order that we who are members of the administration may get to the Cabinet meeting in time) will make you welcome on behalf of the great dairy industry. Since he has made such kindly reference to the department, I think I shall assume the privilege of making you welcome on behalf of our Department of Agriculture—of the great group of scientific men in that department, as well as the humble workers, who have tried to serve you, as Doctor Van Norman has said; and including also the great staff of scientific men scattered throughout our 48 States, all of whom have been working side by side with the practical men to build up the dairy industry, and all of whom have been looking forward to this time and making preparations for it for the past two years.

As we who have been in touch with the development of the industry look back 30, 20, yes, even 10 years, and note the progress which has been made, and then undertake to accredit that progress, in so far as it properly may be accredited to the work of the scientific men, we begin to appreciate what a tremendous debt we owe to these patient research workers in the laboratories as well as in the fields.

No one can adequately appraise the debt the great dairy industry owes to these men of science, not alone that part of the industry which produces the milk but those who handle it all along the line, step by step, from the time the feed is grown until the finished product is delivered to the consumers in the cities.

I wish I might have time this morning to tell you something about that group of scientists who work in the Department of Agriculture. We have there more than 2,500 scientific men—not all of them, it is true, devoting their energies to the dairy industry, but a large number of them serving directly the dairy industry, and many others serving in fields which are related in one way or another to this industry. I believe that is the largest group of scientific men that can be found anywhere in the world gathered together in one place.

They are working side by side with the practical men, starting with the soil, with the plants which grow, with the cow, with her care and management, with her feeding, with her breeding, with her selection for the particular purpose you have in mind; passing on to the process of manufacture, studying how the process may be improved to produce a clean, wholesome, life-giving product, on through the marketing in its various phases, until the milk is delivered, or the products of the milk are delivered to the consumers in the cities.

Every step of the way the man of science is working, either physically or in spirit, side by side with the practical man to develop this great industry.

Not alone those who are giving their attention directly to dairying but the men in the related fields of science—the bacteriologists, the chemists, the plant pathologists, the students of animal disease—are all directly or indirectly making contributions of great value.

Taking the reverse of it, let me give you one illustration of how the research of the man of science may be applied in a field seemingly far removed from the field in which he is working. Many years ago, one of the scientists in the Department of Agriculture made the fundamental discovery that the transmission of certain animal diseases—in this case the Texas fever of cattle—is due to a parasite which infests the animal. Out of that discovery has grown a wealth of scientific knowledge which has been applied for the benefit of the human race throughout the world.

That original discovery of the transmission of disease by a parasite, in the case of Texas fever of cattle, made possible the discovery of the transmission of yellow fever in man, and a large number of other diseases which now, as the result of that discovery, have been brought under control.

So, the research worker wherever he may be, in whatever field he may be occupied, even though remotely connected with the industry in which you are particularly interested may be serving you in a way you can not begin to appraise.

I welcome you on behalf of those men in the department; I welcome you on behalf of those men in the 48 different experiment stations and colleges of our 48 States. If, as the result of your deliberations here, you will find some new knowledge to take away from your contact with our people, we shall be happy, and we shall reserve the right to seek from you in return the knowledge which you bring from the four corners of the earth.

I was looking over your program this morning. When the Secretary of State referred to the evidence of cooperation and its effect upon our world activities, this thought occurred to me: I would like to bring here to this platform the various groups of people who go to make up our national life, and not only our national life but the national life of all countries, and I would like to introduce them to this gathering and put a copy of this program in their hands and call their attention to this fact—that here is a group of people from the field and the farm and the scientific laboratories, gathered together not to consider hours of work, not to consider how to limit production, not to consider how they may scheme and conspire for their own selfish financial benefit, but to consider how they may make production more efficient, how they may make the commodity they produce and process more healthful, how they may get it to the consumer in a cheaper way, how they may perfect the processes all along the line.

I would like to say to these various groups that make up our national life, you should counsel with these people, get the spirit of service which breathes out of every such gathering of this kind and "go thou and do likewise." [Applause.]

My friends, if they would profit from that contact with you and if they would profit from that advice, why, the troubles of this old world would disappear just as the mists of a Washington morning disappear under the rays of the warming sun, and then we would have that cooperation of which the Secretary of State spoke so feelingly, and we would have peace on earth and good will among men. [Applause.]

(At this point a selection was rendered by the Marine Band.)

President Van Norman. As an incident of business, I am going to ask our interpreter to inquire, first, in French and, second, in Spanish, how many delegates there are here who do not understand English. Personally, I have been very much interested and surprised to find how nearly all of our delegates do understand the English language. If it is possible we may not have to repeat very much in some other language. If so, it will permit the meeting to proceed more rapidly. Mr. Safford, of the Department of Agriculture, will make the inquiry, first in French and then in Spanish.

(Mr. Safford did as requested by the president.)

President Van Norman. Secretary Hoover has found it necessary to go to the Cabinet meeting first. The other two Cabinet officers came to this meeting before the Cabinet meeting. So we will hear Secretary Hoover at a little later time.

PRESIDENTIAL ADDRESS.

Hubert Everett Van Norman, LL. D., president, World's Dairy Congress Association (Inc.).

I am happy to join with American scientists and leaders on behalf of the American dairy industry in a hearty welcome to you who represent the governments, science, business, and welfare of other nations. On this platform are the men from abroad who have been designated as representatives of their governments, and officially charged with being present; on the floor before me are you who have come as individuals, or as representatives of firms, associations, organizations, and States. We are pleased to count ourselves of this country a democracy, yet we like a little bit of show, so we place the government delegates here on the platform for you to look at, then we adopt the rule that all delegates are equal as listeners and participants in the congress; so you are all equal whether you sit in the gallery, on the main floor, or on the platform.

This congress was undertaken before the signing of all World War treaties, and under conditions which prompted the dairy leaders of America to take the initiative. With the reestablishment of the active work of the International Dairy Federation, we were happy to secure its cooperation.

This congress is not legislative in character. It has no authority to commit its delegates or the countries they represent to any particular policy or course of action. Its purpose is to effect an international exchange of the newer knowledge of the sciences and practices of dairying, and of the methods and results of a wise use of milk and its products in human diet, and to stimulate interest in world-wide factors affecting dairy commerce. It has been made possible by the successful, public-spirited members of this great industry who have financed the organization of the congress, and the propaganda which has informed the rank and file of dairy science and industry in many lands of the plans for the congress.

Our Government has not only authorized an official invitation to foreign governments to participate, but has provided for the permanent recording and distribution of the proceedings of the congress in printed form.

We of this country are indebted to Europe for our leading breeds of dairy cattle, for early feeding standards, much of our elementary knowledge of dairy chemistry, and bacteriology, the principles of Pasteurization, the use of pure cultures, the early centrifugal separators; for leadership in the standardization of dairy products, especially for export, and for the early cooperative dairy organizations. We, however, think that we have materially developed these gifts and that we have also made a contribution to the progress of the industry, such as the State supervision of advanced registry of yearly production by purebred cows, the systems of production and supervision of high-grade milk for our cities, the perfection of commercial Pasteurization equipment and methods, the development of certified milk, the application of mechanical refrigeration, the development of labor-saving machinery, the development of our immense ice-cream business, the perfection of milk condensing and milk powder manufacture, and the use of attractive 1-pound, or even smaller, rectangular butter packages for retail trade.

Our vast areas of scattered farms, with relatively small herds, have brought about our so-called centralizer creameries, in addition to a system of cooperative creameries so successful in some parts of our more important dairy States.

This congress is a recognition of the world character of the dairy industry, of the interrelationship of all of the countries engaged in dairying, and of the fact that seasonal, climatic, economic, and political changes in any country rapidly affect the prosperity of the dairy industry in other countries. Successful leadership seeks increasing familiarity with these world forces.

Progress is ahead of the printed page. Only by personal intercourse and oral exchange of ideas by the most progressive leaders can the newer developments in science and industry be rapidly made available for the improvement of general practice. The contribution of science to the practices of refrigeration have made possible the shipment of dairy products around the world, tending to equalize prices and counteracting seasonal variation in supplies in the leading markets.

Six great nations are to-day aggressively encouraging increased dairy production. This necessitates increased consumption. The revelations of science and the accumulated data of welfare agencies show immense, untouched markets in every country in that portion of its growing and mature population which, through ignorance and in spite of wealth or poverty, is underfed because of unwise choice of foods and insufficient use of milk. Wider dissemination of these facts is a contribution to human health and to the economic prosperity of the industry.

New problems are constantly confronting this industry. Some of the important ones are the relation of mineral matter to the nutrition of dairy animals, the control of costly diseases, the increased use of mechanical equipment, the influence of larger container units, especially in the handling of milk, the application of mechanical refrigeration to retail ice cream distribution, and the influence of mechanical refrigeration on geographical development of the dairy industry, together with the future trend of cooperative and corporate forms of marketing its products.

In developing the program of this congress, it has been assumed that these problems may be viewed from four angles:

I. That of those whose chief interest is that of scientific investigation and teaching.

Commercial progress in the industry parallels results of the investigator. In some cases, science explains why proven practices succeed; in other cases, science points the way to newer and better practices.

II. That of those who are engaged in the business of production, manufacture, or distribution, and the manufacture of the supplies and equipment essential to the industry.

The further security and profits of immense amounts of capital are vitally affected by the trend of the dairy development in various parts of the world. When an unusually productive season in Australia and New Zealand so floods the markets of England that Scandinavian dairy products are forced to seek a market in the United States, the probable influence of these factors on prices and profits becomes an immediate concern of every business leader, and is here mentioned only as suggestive of the international aspects of this great industry, with Canada, New Zealand, Australia, Argentina, South Africa, and the United States encouraging greater dairy development as a factor of successful agriculture, and Siberia and Russia unknown factors in the future of this industry.

III. That of those who are concerned with problems of regulation and control.

Many of us seem to need outside admonition, or we fail to do that which we know is right. Our American railways did not put automatic breaks on all their cars as protection to the trainmen and the traveling public until forced to do so by Government commission; our medical schools have their standards prescribed by law, and even our automobile drivers are prone to disregard the rights of pedestrians unless policemen enforce them. So our dairy industry is involved in adherence to laws, municipal, State, and National, which define standards of sanitation and quality and guard against adulteration. The enforcement of these laws is in the hands of a small but important group of men in every land anxious to protect the public and serve the industry.

IV. That of those seeking to secure that wise use of dairy products in the diet of the public which shall best promote the nearest perfect development of man.

As students of human welfare and as an industry supplying an essential food, especially for the growth of our young, we owe a debt of gratitude and appreciation to the scientists who have shown, and are showing, us the proper relation of this important product to the everyday life of our people.

As an industry, we cheerfully join hands with health and educational officers and welfare workers in securing the widest understanding and practices of these truths.

Since the purpose of this congress is to bring into the limelight of public discussion the fruits of most recent research and industry practices, a world-wide invitation was extended for the presenting of papers embodying new developments. This program includes 244 papers. Doubtless there are omissions of messages from eminent authorities; possibly there are papers included which could have been omitted. This is unavoidable. The very size of the program requires its subdivision into sections for presentation. Several of these sections will be in progress at the same time. Some of you may be disappointed in not hearing all of the papers you would like to hear because of conflict in the hour of presentation, but I assure you the program committee has striven to so group the subjects as to serve the largest possible number of delegates.

I particularly invite your careful study of the program, and invite your attention to the little schedule on pages 12 and 13. It suggests the general character and scope of each sectional meeting. I hope that it will enable you to find the things which you most wish to hear. Topics will be found indexed in the back of the book.

This congress has the distinction of being the first to include the serious discussion of business problems of the dairy world, and of the relation of the use of dairy products to human health, together with the problems of science and those of regulation. May I express the hope that there may grow out of this congress a larger acquaintance among those men who direct the important industries in the various countries, because, "Acquaintance," as our Secretary of State has said, "is a bond of fellowship," and is a stimulus to progress. May this be an outstanding feature of the congress and a growing force to modify our business practices.

We have reached a point in international interest and relationship where a better understanding of these relationships is most important. I believe our people are interested and eager to participate in that larger and better acquaintanceship.

It seems appropriate that you from foreign lands should assemble here at Washington, our Nation's Capital; that you should be welcomed by our Government, by the men who have made this congress possible, by the men who come from nearly every State in the Union as representatives of business, of science, of education, and of human welfare; that after a glimpse of the city's beauties, you should journey to Philadelphia where we shall present the unique work of the National Dairy Council's efforts to enlarge the public's understanding of its relation to the product which we have to sell; and from there to continue to Syracuse, N. Y., where our National Dairy Exposition will be in progress. We hope the disadvantages of a moving congress may be offset by a larger understanding of our country and our industry's development. With the exception of to-morrow the forenoons of each day will be devoted to the sessions of the congress, while the afternoons will be left free for sight-seeing, which may include places of national and historic interest, as well as the wonderful portrayal of our industry at the exposition, and short excursions from the different cities. The evenings in Washington and Philadelphia will be devoted to the activities of the respective hospitality committees; in Syracuse they will be left free for participation in the annual meetings of the various national associations which take advantage of the annual exposition for the holding of their business meetings. Some of these associations have given up their general and technical sessions in order that their members may participate in the sessions of the congress.

The congress will close with an international dairy dinner, so called as a warning that the formality usually accompanying a banquet will be omitted and that each one is expected to come. We hope that it will be the largest dinner gathering of dairy people that has yet taken place. We shall hope to hear at that time something from the representatives of many lands.

We have, in this country, some 1,300 national and State dairy organizations which play an important part in the rapid dissemination of knowledge and the stimulation of improvement in our industry. This fact and your presence prompt the suggestion of the need of greater coordination in our own industry, and a closer articulation with the world's dairy organizations, and the hope that further international meetings, while accentuating the cause of science, will give greater recognition to the part which the organization of the industry plays in the application of science to commerce, and, finally, the wider cultivation of society's appreciation of its dependency on a successful dairy industry for lowering the human death rate and increasing the physical efficiency of men and women. [Applause.]

President Van Norman. We have time before Secretary Hoover can arrive from the Cabinet meeting for me to tell you just a little of the development of the plans for the congress.

It was my pleasure, as a representative of our committee, to attend the International Institute of Agriculture at Rome last year.

and to travel through the different countries of western Europe, to call on several of the influential men in each country, and to tell them of the plans for the congress; to learn from them something of the peculiar conditions in their respective countries, to learn of those who should participate in the program of this congress, and to thus lay the foundation for the splendid cooperation which we have had in the development of plans. I found in several countries organized committees; in others active committees had been established, and the presence of the distinguished body of delegates here to-day is evidence of the success of the splendid cooperation we have had.

In addition to the information concerning the congress supplied to newspapers of many countries through their cooperating committees, over 1,000 foreign newspapers have been supplied with news items direct from our office. In our own country we have supplied the leading papers of all the larger cities through the several national news distributing agencies. It has been the purpose of this congress, so far as possible, to develop in the Congress of the United States, among the officials of our Government, among the editors of our urban press, and the residents of our cities, a fuller realization of the importance of a successful dairy industry and the service it renders to those who dwell in the cities.

We have sought to use the news incident to the coming of you men and women from foreign lands as a vehicle for carrying to city readers a little story of what a wonderful thing milk and its products are, how important they are, and something of the problems involved in their successful production and distribution to the homes of our people. Because of the public-welfare character of this congress and the absence of any immediate money-making schemes, because the doors are open to all, and because our purpose is to help society to grow stronger and better children, the papers of our land have been most generous in publishing the news of the congress with their dairy stories. Our clippings show that they have been published in thousands of papers at home and abroad.

Invitation to participate in the congress has been extended not only by our Government to foreign governments, but by this association through governments and direct to states, provinces, and associations of any and every character interested in any phase of the science and industry dependent on or related to the dairy cow. This invitation has gone to over 200 railroad presidents, many of whose companies maintain educational dairy development departments. We realize that it is not possible for hundreds of thousands of people to attend such a congress, but that it is possible for nearly every organized group to have present a spokesman or an auditor, to meet and exchange ideas with you and take back to his community something of the fruits of progress presented here, something of the inspiration that grows from participation in this congress. I venture the hope that this may be but the forerunner of a closer working together of all these organizations at home and abroad to the end that we may more quickly get into use and practice the good things which develop in our annual meetings and in these semi-occasional international meetings.

Our country is big. Some of our guests from abroad have found it possible to traverse the length of the land. Others have gone but part way. There will be additional excursions and opportunities to see. I bespeak for the many who can not extend the invitation themselves, a hearty invitation to every one of you who comes from foreign lands, to spend as much time with us as your circumstances may permit, to the end that you may see that which most interests you. I am sure that all who are here share in this invitation.

With so many opportunities and so much going on, we have found that the only way to inform you of these activities is to embody them in this printed program, and place it and other information in the envelope which has been handed to each of you who has registered.

May I remind you that the committee for Washington and vicinity has arranged for an excursion to Mount Vernon this afternoon, when you will be the guests of this commitee, under the leadership of Mr. Ivan C. Weld, and the group of men who are assisting him. In Philadelphia, you will be the guests, from the time your train stops on Thursday morning until you leave, of the dairy interests of the Quaker City, where the producers and distributors of dairy products will join hands in a hospitality which I am sure you will all enjoy.

In Syracuse, the chamber of commerce and the dairy leaders of New York State will do all in their power to make you comfortable and your sojourn pleasant.

Do not forget to look over your coupons, and file those relating to the activities you wish to join in. The several committees must know how large to make the cake and how many "Fords" to provide.

(At this point a selection was rendered by the Marine Band.)

(The delegates arose and applauded as Secretary Hoover came upon the platform.)

President Van Norman. I said earlier in the program something of the relation of our great industry to human welfare. Out of the recent war have grown some very instructive facts. We are fortunate to-day that we are to have brought to us a message growing out of that side of this terrible conflict. We are to have that message brought to us by a man whose name is known to all of us for his wonderful ability to coordinate the effort of an immense number of people, a man who views this great industry of ours from two standpoints—that of the cold eye of business and commerce, by virtue of his office in our Government as Secretary of Commerce, but infinitely more important than that, he views this great industry of ours from the standpoint of its relation to human life and human health and the making of a larger proportion of coming generations well and strong.

It is indeed an honor to our industry, and it is an honor to us who have privilege of being here, that we are to hear this morning from the Hon. Herbert Hoover, Secretary of Commerce.

(The delegates arose and applauded.)

DAIRY PRODUCTS' PLACE IN IMPROVEMENT OF HUMAN HEALTH.

Herbert C. Hoover, Secretary of United States Department of Commerce, and president, American Child Health Association.

I am indeed glad to participate in the official welcome of our Government to you in this conference. We believe that these conferences have a fundamental value in the whole of the problems of the world, that the gathering together of men and women who are interested in these, the fundamental things of human life and health and comfort, are a real contribution to progress.

You represent a great many associations in all parts of the world, devoted to the promotion of this great industry. The functions of the organizations you represent are not alone those of the promotion of the welfare of agriculture, nor alone those of the production of a better food supply, but you have a treble function, and that is the function of human welfare, because upon this industry, more than any other of the food industries, depends not alone the problem of public health, but there depends upon it the very growth and virility of the white races.

The exhaustive researches of nutritional science during the last two decades have, by the demonstration of the imperative need of dairy products for the special growth and development of children, raised this industry to one of the deepest national and community concern, for, as I have said, it is not alone the well-being of our people but it is the very growth and the virility of our race to which you contribute.

If any further demonstration were needed than the results of scientific research, as to the importance of dairy products in our national diet, the experience of the American Relief Administration, of which I had the honor to be chairman, in its work of provision of the necessary food supply first and last to over 12,000,000 children in various famine areas of Europe, could be drawn upon for literally volumes of confirmation.

The feeding of these masses of undernourished children demonstrated from the outset that there was no substitute for milk, and that while a very wide range of alternatives existed among other foodstuffs, this particular commodity was absolutely essential for their restoration to health and their maintenance. It is perhaps interesting to note that this organization and its allied organizations exported from the United States, for the use of these children, upward of 500 millions of pounds of condensed milk during the period of the war and reconstruction. It could be very well said that the saving of these millions of children was accomplished only by virtue of the strength, the resilience, of the American dairy industry.

The war greatly disrupted all agricultural production, and in no case more than dairy production. There was not only the great depletion of cattle in Europe but even more destructiveness, for the human animal under food pressure at once substitutes the production of bread grains for feed and thus reduces the productivity of his herd. It is but a part of the story of these disruptions that the United States started from no consequential pre-war exports of condensed milk, and yet has shipped to Europe a total of over 2,000,000,000 pounds up to last year.

Nor has the world yet recovered its equilibrium in dairy production, for the supplies from many countries in central and eastern Europe are far below pre-war normal, a pertinent evidence indeed of the lower standards of living throughout the whole of that area.

It is a safe generalization, I believe, from a nutritional point of view, that the world is to-day overproducing bread grains and underproducing dairy products and consequently the feed grains and other animal foods.

With the partial recovery of Europe the exports from the United States have steadily declined, but I am happy to say that the steadily increasing consumption of dairy products at home, due both to the increase in our standard of living from full employment of our workers and from a better understanding of the value of dairy products, has enabled our dairy farmers to weather the storm of agricultural reconstruction rather more satisfactorily than the producers of breadstuffs and other agricultural produce.

Despite the increase in consumption in the United States during the last decade, I believe that any analysis of this subject will indicate that we are yet far below the intake of dairy products which would maintain the maximum results in health and the development of our children.

The shift in the proportion of our population from the farms to the towns through the vast industrialization of our country has imposed this problem upon us.

By the nutrition of hundreds of generations, the fate of the white races is indissolubly linked with their cattle. It is natural enough, and easy enough, to furnish children with ample milk supplies upon the farm. It is infinitely more difficult to induce our urban populations to consume a sufficiency of milk and to do so under hygienic conditions, for it requires the education not alone of children but of parents; it requires the substitution of foodstuffs that are in appearance, at least, more expensive for those that are less expensive.

It is necessary to make this substitution on a basis of reason rather than on a basis of quantity and appearance. There is nothing of more importance to our American public to-day than the realization of this primitive necessity of the nutrition of children and the responsibilities of the entire community for it.

You will hear a great deal in these sessions as to the effort being made to reenforce the consumption of our dairy products. I have the honor to be the president of the American Child Health Association, an organization devoted to problems of children's physical welfare. That association is engaged at the present moment in carrying on at a very large annual expense an actual demonstration in four typical localities of the United States of what shall be done in the matter of children.

These demonstrations are conducted in cooperation with the medical profession and the public officials of those localities. As far as the demonstrations have gone to date, they show that even in moderate-sized and semiagricultural towns, our consumption of milk by children is less than one-half what it should be.

That association, besides seeking to build up in certain localities a demonstration of the ideal of child health, is now about to undertake, so far as its resources will permit, a systematic survey of the different communities in the United States with regard to their status in the care of children. Their first criterion in the judgment as to the performance of a community of its duty is a study of its milk supplies, both as to quantity and purity. That association hopes to grade the different towns in the United States as to whether or not they are satisfying their public officials, with the hope that an exhibit of the relative performance of different communities may induce a proper attention to their most vital of problems.

Now I scarcely need to dwell on the importance of the economics of the dairy industry, from the point of view of agriculture itself. Indeed the dairy industry from the point of view of the Secretary of Commerce, is the great balance wheel on agriculture. There have been a great many changes in the past few years, but by far the largest proportion of these 23,000,000 dairy cows that we possess in America are maintained in small herds of under 10 cows each. For the most part, they are supported by the by-products of agriculture. They secure a profitable employment to the farmer's labor during the year.

The development of mechanical devices in the last two decades, in the shape of hand separators and the motor truck, the development of the cooperative centralized creameries, have all contributed to an extension of the dairy industry to regions that are remote from urban areas, and have greatly added to the security of the entire agricultural industry.

There is, in the possibility of increasing the consumption of dairy products, an element of solution to many of the present agricultural problems. As I have said, world agriculture has come out of the war thoroughly unbalanced. We are overproducing bread grains beyond any possibility of consumption in the world at the present moment. To bring about an increase in the consumption of dairy products is not only a health question but it will also lend a substantial hand to agriculture in the conversion from bread grains to feed, and in this fundamental increase in living standards an actual gain can be made for the total consumption of agricultural produce.

By so doing, we will be promoting not alone the interest of agriculture, but we will be promoting the interest of public health and the virility of our race.

One of the purposes of your body is, no doubt, to improve the method and well-being of agriculture itself. This is indeed a great purpose. It has another great purpose, to improve the conditions surrounding dairy production and the hygiene of its distribution. It has an even greater purpose than this, as I have said before—that is the inculcation of the need and the necessity for an increase in the use of milk by our children as a fundamental contribution to the strength and future of the white race.

Thank you. [Applause.]

President Van Norman. We have another communication we will ask Mr. Greene to read for us.

Secretary Greene. The communication is as follows:

October 1, 1923.

My Dear Professor Van Norman: Finding that public engagements make it impossible for me personally to welcome the delegates to the World's Dairy Congress at their opening session, I am writing to ask if you will express my gratification that so many delegates have accepted the inviation to this gathering. I learn that in response to the invitation extended by the President on the authority of the Congress, representatives will be present from 40 nations. This is surely an auspicious showing, for it can not fail to be of real accomplishment as the result of bringing together so large and representative a gathering of people speaking for the world's interest in one of its foremost industries. The universal use and widespread commerce in dairy products have so far developed that the welfare of the industry in every country is of concern to every other.

Through such a gathering as this the researches of science are made available to all the world. The knowledge of inventions and labor-saving devices is exchanged to the advantage of all; yet more important is that attention will be focused by such a gathering upon the health-giving and growth-promoting qualities of milk and its products.

Your deliberations will not fail to be instructive and interesting. I wish to express the hope especially that those who have come among us from abroad may find their stay agreeable and profitable, and that they may return home in safety, with the feeling that they have been more than repaid for their journey.

Most sincerely yours,

CALVIN COOLIDGE.

[Applause.]

President VAN NORMAN. We will have an announcement to make at to-morrow's session concerning an invitation to meet the President.

(President Van Norman then made announcements concerning the excursion to Mount Vernon.)

President VAN NORMAN. I will ask the secretary to read this cablegram.

(Secretary Greene read the cablegram.)

MILAN.

Committee of the International Dairy Exhibition, Milan, April, 1924, send applauses and wishes to World's Dairy Congress.

GORINI, *President.*
LUCCHI, *Director.*

[Applause.]

President VAN NORMAN. Announcement is made that the Capitol will be open Wednesday evening from 7.30 to 10. Delegates from abroad and at home who may desire to visit the Capitol at that time are invited to do so and are urged to go as nearly 8 o'clock as possible, and that as many as possible go at the same time in order to facilitate their conduct through the Capitol.

All those not resident in the United States are invited to assemble outside this building for the taking of a photograph of the foreign delegates, immediately on the conclusion of this meeting. The official photograph of all the delegates will be taken at the White House and at an hour to be announced to-morrow. The President has consented to be " shot " with us. [Applause.]

To-day we have complied with the formalities. To-morrow is the business session. You must get up a little earlier to-morrow. The chairman of the program committee wants to see you here to-morrow at 9.30. There won't be any music; it will be business from the very beginning.

I wish to make announcement of the banquet this evening as guests of the Washington committee. I hope you have all put in your slips, or will do so, to let them know that you will be there.

Mr. Secretary, is there anything further?

Secretary GREENE. Nothing that I know of, Mr. President.

President VAN NORMAN. Then we will stand adjourned.

(The meeting adjourned at 12.10 p. m.)

SESSION 2. INTERNATIONAL TRADE.

Honorary chairman, ROBERT WALLACE, emeritus professor of agriculture and rural economy, University of Edinburgh, Scotland.

Chairman, Dr. C. W. LARSON, chief, Dairy Division, United States Department of Agriculture.

Secretary, H. H. WING, professor of animal husbandry, New York State College of Agriculture, Cornell University.

MEMORIAL CONTINENTAL HALL,
Washington, D. C., Wednesday, October 3, 1923—9.30 a. m.

Chairman LARSON. Ladies and gentlemen: The plight of the wheat farmers of this country has turned out to be the plight of the dairymen this morning. The Hon. Sydney Anderson, president of the Wheat Council of the United States, was scheduled for the chairmanship this morning, but because of his need in Chicago to-day, where that council was meeting, it was not possible for him to be here. I am therefore going to try to substitute for him.

There is a rule of the congress which provides that when an author of a paper is not present, that paper must be passed on to the bottom of the program of that session. Then when we reach that paper a vote will be taken to determine whether the paper will be presented by some one other than the author.

It so happens that the author of the first paper is not present and, according to rule, it will be necessary to pass that subject until the others have been completed.

The first speaker this morning, therefore, I want our honorary chairman to introduce. I would like that pleasure myself, but we want Professor Wallace, of Scotland, to have that honor. Professor Wallace. [Applause.]

Honorary Chairman WALLACE. Mr. Chairman, ladies, and gentlemen: It is my great pleasure to introduce to you this morning Mr. J. A. Ruddick, who is the Dairy and Cold Storage Commissioner of Canada. The subject of his paper is, " Some aspects of the international trade in dairy produce."

In a word I want to say to you that Mr. Ruddick has been trained in the proper school. Mr. Ruddick was first brought up practically in trade, and he knows his business from the foundation. Then he joined Doctor Robertson's staff (Doctor Robertson has been the greatest dairy administrator of Canada), and Mr. Ruddick is now here to tell us what we want to know about his subject. I shall not stand between you and the lecturer, but will ask Mr. Ruddick to address you. [Applause.]

Mr. J. A. RUDDICK. Mr. Honorary Chairman, Mr. Chairman, ladies, and gentlemen: I would just like to say one word before I begin my paper, as to the success which has attended this congress up to the present time. I want, in a word, to congratulate the officers and those who have been charged with this organization on the splendid way in which they have performed the task. Everything has moved along smoothly and without the slightest hitch, and I am sure you will all agree with me that, apart from the congress itself, we have enjoyed our stay in Washington up to this time.

I have one word to say on that. Coming from Canada, it is a little difficult for me, as well as other delegates, to consider ourselves as foreigners in the United States. [Applause.] Our relations for many years, so far as I am concerned, have been so close with the people of this country that I always feel at home when I come over here. I had two brothers; one of them died an American citizen and the other is still an American citizen, and my life's partner came from the State of New York. [Applause.] She says she is an American yet, although under the law she is a British subject. But what can you do anyway with a woman who presents you with your only child on the Fourth of July? [Laughter and applause.]

Now, Mr. Chairman, I understand that time is precious and I shall not waste any more of it in preliminaries.

SOME ASPECTS OF THE INTERNATIONAL TRADE IN DAIRY PRODUCE.

JOHN A. RUDDICK, Dairy Commissioner, Ottawa, Canada.

There has been an international trade in dairy products within the Northern Hemisphere for many years, but climatic and transportation conditions prevented any important movement of butter and cheese across the Equator until about 40 years ago. It was a momentous event in the dairy world when on January 17, 1881, the steamship *Protos* landed 100 tons of Australian butter in London in good condition. This successful application of mechanical refrigeration in the overseas transport of butter and cheese opened the markets of the Northern Hemisphere to the products of the extensive pasture lands of New Zealand, Australia, Argentina, and South Africa, and thus placed the dairy-produce market on a world's basis.

Not only did the advent of refrigeration improve the transport of such perishables as butter and cheese, but by providing facilities for safe storage over lengthened periods, markets were expanded in point of time as well as distance. Furthermore the better preservation of the quality in butter induced a much greater consumption and thus enlarged the market in that sense also.

The development of the dairy industry in the Southern Hemisphere was rather slow at first, but within the last 10 years the growth of the exports of butter and cheese from New Zealand, Australia, and the Argentine have been so large as to make profound changes in the direction and volume of the streams of dairy produce which supply the world's demand.

There is a considerable movement of dairy products, and always will be, between many different countries, for geographical and seasonal reasons, or to supply particular tastes; but as these pretty nearly balance themselves I have, in preparing this paper, confined myself largely to an analysis of the imports of butter and cheese into the United Kingdom of Great Britain.

The United Kingdom is not the only international market for dairy products, but it is the principal one, as it absorbs much more butter and cheese than all the other countries in the world combined.

During the years immediately preceding the war, Germany, next to the United Kingdom, was the largest importer of butter, but received only 16 per cent of the world's total exports, as against 67 per cent received by the United Kingdom. Belgium came next to Germany in that period as an importer of butter, but the total quantity amounted to only 2 per cent of the world's trade.

In the case of cheese the trade was somewhat more distributed before the war. The United Kingdom absorbed about 50 per cent of the world's exports, France and Germany something like 9 per cent each, United States a little over 8 per cent, and Belgium 5 per cent, and so on.

It may be of interest to note the changes in the imports of butter and cheese into the United Kingdom by countries during the last 20 years. In 1903 Denmark supplied 45 per cent of the total imports of butter. Russia came second with 12 per cent, then followed France, Holland, Canada, Sweden, and New Zealand in the order named, the latter supplying only 5 per cent. Italy and the Argentine came next with 2 per cent each, and the United States with 1 per cent. In 1914 Russia had increased her quota to 14 per cent and Denmark was reduced to 41 per cent. Australia took third place in that year with 12 per cent, and New Zealand advanced to fourth place with 7 per cent.

In 1922, the imports from Denmark were only 35 per cent of the whole, while Australia claimed 27 per cent, New Zealand 23 per cent, and the Argentine became an important factor for the first time with 9 per cent. For the year ending June 30, 1923, Denmark again supplied 35 per cent, New Zealand followed with 27 per cent, and Australia was down to 13 per cent, the exportable surplus being reduced by climatic conditions. The Argentine Republic's contribution was up to 10 per cent, and Canadian shipments were also increased to 3 per cent of the total. The United States, Sweden, France, and all other countries combined supplied 10 per cent.

In 1903 Canada supplied 68 per cent of the total cheese imported into the United Kingdom, United States 14 per cent, Holland 13 per cent, and all other countries combined 5 per cent. In 1914 Canada's contribution was reduced to 51 per cent and New Zealand jumped to second place with 28 per cent. Holland again supplied 13 per cent, Italy 4 per cent, United States and Australia each 1 per cent, and all other countries combined 2 per cent. In 1922 New Zealand took the lead in cheese with 50 per cent of the total, Canada 39 per cent, Australia and Holland each 4 per cent, United States 1 per cent, Italy, South Africa, and Switzerland together 1 per cent, all other countries 1 per cent. In 1923 New Zealand supplied 52 per cent, Canada 32 per cent, Holland 7 per cent, Italy 3 per cent, Australia 2 per cent, United States 1 per cent, and all other countries 3 per cent.

(Further details on this point will be found in Table I.)

TABLE I.—*Percentage imports of cheese and butter into the United Kingdom, by countries.*

1903.

Country from which imported.	Per cent.	Country from which imported.	Per cent.
CHEESE.		BUTTER—continued.	
Canada	68	Canada	6
United States	14	Sweden	5
Holland	13	New Zealand	5
Other countries	5	Italy	2
		Argentina	2
	100	United States	1
BUTTER.		Norway	1
		Australia	
Denmark	45	Other countries	1
Russia	12		100
France	11		
Holland	9		

1914.

Country from which imported.	Per cent.	Country from which imported.	Per cent.
CHEESE.		BUTTER.	
Canada	51	Denmark	41
New Zealand	28	Russia	18
Holland	13	Australia	12
Italy	4	Sweden	8
United States	1	New Zealand	7
Australia	1	France	6
Other countries	2	Holland	4
		Argentina	2
	100	Norway	1
		Canada	1
			100

1922.

Country from which imported.	Per cent.	Country from which imported.	Per cent.
CHEESE.		BUTTER.	
New Zealand	50	Denmark	35
Canada	39	Australia	27
Australia	4	New Zealand	23
Holland	4	Argentina	9
United States	1	Finland and Russia	3
South Africa	1	Holland	1
Switzerland		Canada	1
Other countries	1	South Africa	1
		Sweden	
	100	France	
		Norway	
			100

1923.

Country from which imported.	Per cent.	Country from which imported.	Per cent.
CHEESE.		BUTTER.	
New Zealand	52	Denmark	35
Canada	32	New Zealand	27
Holland	7	Australia	13
Italy	3	Argentina	10
Australia	2	Canada	3
United States	1	Holland	2
Other countries	3	United States	10
		Finland	
	100	Sweden	
		France	
		Other countries	
			100

The most striking feature of these figures is the rapid increase in the exports from New Zealand. That country is now the largest exporter of cheese, and if the exports of butter show the same increase in 1923–24 as they did in 1922–23 they will then exceed those of Denmark, and New Zealand will be the largest exporter of both butter and cheese of any country in the world.

The export trade in dairy products from New Zealand began in a very small way about the year 1883. In 1904, at the end of 10 years, the quantities exported were 35,000,000 pounds of butter and 9,000,000 pounds of cheese. For the year ending March 31, 1923, the exports were 142,000,000 pounds of butter and 145,000,000 pounds of cheese.

In 1914 Russia exported 118,000,000 pounds of butter. At the present time, as far as figures are available, Russia is a very unimportant factor in the international butter trade. As an offset to the disappearance of the Russian exports, it may be pointed out that in 1914 Germany imported 111,000,000 pounds of butter, and as far as I am aware very little is being imported at the present time. These two items, the decrease in the exports from Russia and the decrease in the imports into Germany just about balance each other.

(For the total imports, by years, see Table II.)

TABLE II.—*Total imports of butter and cheese into the United Kingdom for years ended June 30.*

Year.	Cheese.	Butter.
	Pounds.	*Pounds.*
1903	290,301,760	448,416,640
1914	264,756,800	478,092,160
1922	310,083,200	422,859,440
1923	316,945,786	529,338,096

Another view of the international trade shows the remarkable development of the exports from the Southern Hemisphere since 1903. In that year the butter imported into the United Kingdom from south of the Equator was only 7 per cent of the total imports. In 1914 the proportion had risen to 21 per cent. In 1923 it was 44 per cent. The proportional as well as the absolute increase in the imports of cheese from the Southern Hemisphere is even more striking. In 1903 only 2 per cent of the imports of cheese came from that part of the world; in 1914 the south supplied 29 per cent, and in 1923 as much as 55 per cent. (See Table III.)

TABLE III.—*Imports of butter and cheese into the United Kingdom from the Northern and Southern Hemispheres.*

Year.	Butter.		Cheese.	
	Southern Hemisphere.	Northern Hemisphere.	Southern Hemisphere.	Northern Hemisphere.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1903	7	93	2	98
1914	21	79	29	71
1922	60	40	54	46
1923	44	56	55	45

There is still another view that may be of interest, and that is the proportion of imports into the United Kingdom of butter and cheese which are of foreign as compared with that of British origin. In 1903 only 12 per cent of the butter came from British dominions, while 88 per cent was of foreign origin. In 1914 British countries supplied 20 per cent, and 80 per cent came from foreign countries. In 1923 we find that 44 per cent was of British origin and only 56 per cent was foreign. In the case of cheese 30 per cent was foreign and 70 per cent Britsh in 1903. In 1914 the supplies of foreign origin dropped to 19 per cent of the total. In 1923 only 13 per cent was foreign, while 87 per cent was British. (See Table IV.)

Table IV.—*Imports of butter and cheese into United Kingdom from foreign as compared with British countries.*

Year.	Butter.		Cheese.	
	Foreign.	British.	Foreign.	British.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1903	88	12	30	70
1914	80	20	19	81
1923	56	44	13	87

As a result of the war some of the streams which make up the international trade in dairy products have been diminished, if not wholly dried up, while others have been greatly increased, and still others have been diverted into new channels. The industry suffered by actual loss of cattle and through the difficulty, if not impossibility, of securing sufficient supplies of concentrates for feeding in many European countries. Outside of Europe, however, the high prices generally stimulated production.

In New Zealand the rapid natural increase was accelerated very considerably, and there is no question as to the present volume of production and exports being maintained and further increased. The manufacture of butter evidently received a big impetus from the war demand in the Argentine, as the imports from that country into the United Kingdom were increased from 5,281,920 pounds in 1914 to 37,679,040 pounds in 1922. It remains to be seen to what extent this increase from the Argentine will be continued.

An instance of the diversion of trade since the war is to be seen in the case of Holland, who now finds her principal markets in Belgium, France, and Spain, rather than in Germany, Austria, and the United Kingdom. The vagaries of the exchange market have also influenced the direction and volume of the streams of dairy produce to some extent.

I do not pretend to say when we may expect the international market for butter and cheese to reach the same state of equilibrium that it had before the war. One thing is certain, that the Southern Hemisphere will play a much bigger part in the international trade in the future than it has in the past.

In New Zealand the climatic conditions are on the whole favorable only to pastoral industry. The rainfall is abundant, and with only slight frosts at any time of the year the cattle run on pasture the year round without stabling. Cattle raising for the frozen-meat industry has become unprofitable in that country, and sheep farming is checked by the high price of land. Dairying seems to be the natural and almost the only line open for further agricultural development. Well-informed New Zealanders expect to see an increase of 100 per cent in dairy exports in the next 10 years. New Zealand, in common with other dairying countries of the Southern Hemisphere, has a relatively small industrial population and therefore a small home market. The proportion of the total production available for export is comparatively large in all the countries of the Southern Hemisphere.

In parts of Australia considerable further development of the industry is expected, especially in the State of Queensland. With modern appliances, including refrigerating machines, a semitropical, or even a tropical, climate is no longer considered inimical to the growth of the dairying industry.

Even in such an unlikely place as the Fiji Islands the creamery industry has already been established. There are millions of acres in the two main islands alone that are capable of carrying very nearly one cow to the acre the year round. The average temperature in Fiji is about 82° F., with heavy rainfall. The growth of such tropical grasses as para, paspalum, mission, etc., would amaze a Temperate Zone farmer. Alfalfa may be cut 10 or 12 times a year. From personal knowledge of the country, I am satisfied that initiative and enterprise are all that are lacking for the building up of a successful industry on quite a large scale, but these are important, and I mention Fiji more as a possibility than a probability for the present.

Many parts of South Africa seem to offer good opportunities for dairying. Cheddar cheese from East Griqualand won first prize at the Royal Dairy Show in London last year.

There is every reason to believe that the exports of both butter and cheese from New Zealand, Australia, South Africa, and possibly the Argentine will show important increases in the future, especially those from New Zealand.

Canada has for many years been an important factor in the international trade. The exports of butter reached the high point of 34,128,944 pounds in 1903, and those of cheese reached the maximum of 233,980,716 pounds in 1904.

In the years that followed the increase of population was greater than the increase of production, and shipments of both butter and cheese have decreased. For the fiscal year ending March 31 last. the exports were 114,548,900 pounds of cheese and 21,994,576 pounds of butter.

The exports of cheese from Canada will probably not show any large increase in the immediate future. The production of creamery butter has been steadily increasing in every province for some years, and larger exports of butter may be expected in the years to come. The dairying industry is well established in every Province of Canada, but outside the Provinces of Ontario and Quebec the production is only a fraction of what it may be in the future. There are vast areas well adapted for dairying in which the industry only awaits development.

The dairy industry has been so fully developed throughout Scandinavia and in Holland, France, and northern Italy that any further expansion of the industry is not likely to be very large. In Switzerland there has been a tendency of late years to divert milk formerly used for cheese making to the raising of calves. The Swiss have found good markets abroad for young cows raised at high altitudes in the Alps.

The most encouraging feature of the outlook for the international trade in butter and cheese lies in the greatly increased consumption of milk and its products. Prohibition in some countries, and the advertising campaigns based on the newer knowledge of nutrition, have had a very important influence in increasing the consumption of dairy products. Few realize how much a very slight increase in the per capita consumption affects the total supply and demand.

A calculation based on the recently published figures of the total production of milk in these United States shows that if the home consumption of milk and its products was increased by only 1 per cent it would mean the equivalent of 100,000,000 pounds of cheese, or nearly 50,000,000 pounds of butter a year.

The possibilities of increased markets through greater consumption are enormous, and what applies in the United States will apply in other countries according to population and per capita consumption. A more widespread knowledge as to the value of milk and milk products in the diet, and a higher appreciation of milk as a food rather than as a beverage, will yet exert a very large influence on the quantity consumed.

If I were writing that to-day, instead of several weeks or months ago, I should have probably placed a little more emphasis on the importance of the Baltic States in the future. From information which has come to me recently, it appears evident that Finland, Latvia, Esthonia, and those other states around the Baltic are likely to increase their exports of butter and some cheese, to a very large extent in the near future. I heard a prediction from a good authority not very long ago that he thought these states (known now as the Baltic States) would probably export more dairy produce than the whole of Scandinavia in a very few years. I don't know whether that is correct or not, but I would place more emphasis on the importance of these countries than I have done in this paper if I were writing it to-day.

Chairman Larson. Mr. Ruddick, we are pleased with the splendid analysis of the situation in trade and dairy products.

I am now pleased to present the chief of the Bureau of Animal Industry of the United States Department of Agriculture, who is well prepared to discuss the important subject of "International trade in dairy cattle." Dr. J. R. Mohler. [Applause.]

INTERNATIONAL TRADE IN DAIRY CATTLE.

John R. Mohler, A. M., V. M. D., D. Sc., chief, Bureau of Animal Industry, United States Department of Agriculture.

Mr. Chairman, ladies and gentlemen of the congress: It is indeed a pleasure to address an audience of this kind, united as it is by one common interest. We are here to honor the dairy industry of the world, to express our congratulations upon its achievements and our confidence in its future. I deeply appreciate the honor as well as the responsibility of having been chosen to bring before you this morning the message regarding the international trade in dairy cattle.

A discussion of international trade in dairy cattle is especially appropriate at an event like this where representatives of so many foreign countries have gathered. Most of you are familiar with the magnitude of the dairy industry in the United States. It is one of our great agricultural and commercial enterprises. Yet unlike most of our important industries, it is one that has been transplanted from abroad. Dairy farming in the United States is essentially the result of international trade. True, conditions have been favorable for dairy cattle and dairy manufacturing, but as we enumerate our leading breeds—Holstein, Jersey, Guernsey, Ayrshire, and Brown Swiss—we are reminded that the original stock was imported. It is rather interesting in this connection to note how this transplanted industry has grown, for it gives a conception of future possibilities that is hard to get in any other way.

Roughly speaking, there are fully 500,000,000 cattle in the world, of which about 100,000,000 are milk cows. And of those 100,000,000, about 25,000,000 are in the United States. So far as I have been able to learn, this is the largest number for any country. Russia is credited with about 15,000,000 and India with about 10 000,000, including some buffaloes kept for milk. Germany is reported to have about 8,000.000 milk cows, France about 6,500,000, and other countries smaller numbers. The figures I have mentioned are only an approximate index to the number of dairy cows, because statistics are not gathered in a uniform way. Yet the evidence shows rather conclusively that the United States, by importing European breeds, has built up a dairy industry of great size.

It may appear unusual also that this country, which has only about one-sixteenth of the world's population, should have one-fourth of the world's dairy cows, and stranger yet that it should have no exportable surplus of dairy products under these circumstances. But such is the case. At times we have exported 1 or 2 per cent of our dairy production, but this year the balance appears to have swung in the opposite direction. From present information imports may exceed exports for the calendar year 1923. Abundant consumption is the explanation. Thus you will see in what esteem we hold the dairy cow and her products.

EXCHANGE OF KNOWLEDGE ON DAIRYING DESIRABLE.

The foregoing remarks, I trust, may help us to appreciate more fully the problems of international trade in dairy cattle. The health of dairy livestock is one problem—perhaps the chief one. There is no place for diseased cattle, or cattle exposed to contagious diseases, in international trade. Health problems deal also with possible infection from hay, straw, bedding, and animal products.

Another problem in international trade is that of giving and receiving information. As already pointed out, statistics of the dairy industry are not gathered in a uniform way in different countries. Such classification terms as "dairy cows," "milk cows," and "cows kept for milk" are more or less synonymous, but we have been unable to get dependable information on the numbers of dairy bulls and dairy animals other than cows. Such stock appears to be included with beef cattle in some cases. If the international aspects of the dairy industry are to be dealt with intelligently, it certainly is desirable to know the extent of the industry in the countries concerned.

Another topic worthy of mention is the desirability of personal observation. I hope that everyone who is here temporarily from a foreign country will make the most of the opportunity to visit farm dairies and dairy manufacturing plants. We want you to see also that this country is entirely free from certain animal diseases, such as pleuro-pneumonia and foot-and-mouth disease, that tuberculosis is being eradicated from thousands of herds, and that the cattle tick is gradually being eliminated from the States which formerly suffered from this pest. Cases have come to my attention in which well-informed persons could not conceive that foot-and-mouth disease was entirely absent in a country of this size, and that it was possible to eradicate cattle ticks from an area of 500,000 square miles. Anyone who has seen hundreds of young ticks crawling on a single blade of grass can easily be skeptical when told that such a pest has been eradicated from large areas, but I hope that you will see for yourselves that this has actually been accomplished.

MODERN CONDITIONS MAKE DISEASE CONTROL IMPERATIVE.

Probably in all progressive countries the majority of dairymen and stockmen understand the necessity for regulations to safeguard the livestock industry. Yet we must face the fact that a minority either is indifferent or is unconvinced that restrictions are necessary. Consequently public opinion is not a sufficient safeguard, and adequate legislation properly enforced is the only dependable means for accomplishing desired results. Cattle, sheep, and swine collected from wide areas are assembled in public stockyards and intermingled in ways most favorable for the spread of infection. The more extensive the movement of livestock, and especially through public markets, the greater the danger of spreading contagious animal diseases, with possibility of disaster to the industry in some localities. A country which in former times was practically safe from outside plagues is now in danger of having them brought in with commerce, and with improved facilities for the transportation and marketing of animals, diseases occurring to a small extent in limited areas of a country are liable to be spread through its territory.

Live animals are moved from one country to another for slaughter, for work purposes, for exhibition, and for breeding purposes. The latter class constitutes the greatest danger. Newly acquired breeding animals which are not free from disease may defeat the very purpose for which they were imported by infecting and destroying the herds into which they are introduced instead of improving them.

The history of dairying in the United States and other countries is replete with instances where valuable herds have been ruined through the introduction of tubercular animals, while the infection of contagious abortion and other more acute transmissible diseases has often been introduced in this manner and spread over large areas with great losses to the industry.

The need for protection against these dangers has led to the formation in most countries of governmental agencies to safeguard the health of livestock and thus conserve this valuable source of food, clothing, and money. Livestock sanitary police organizations of varying forms and efficiency are now found in most countries where the animal industry has been developed to an extent that it has become an important industry. The object of such organizations usually is threefold: To protect domestic livestock from foreign contagion, to prevent the spread of animal diseases within the country, and to eradicate such diseases as may be present. These are fundamental functions, essential for the protection and prosperity of every country engaged in the production of dairy products and meat.

Nations are dependent on each other to a large degree in the matter of preventing the spread of animal diseases from one country to another and it is gratifying that with the increase of commerce in animals and their products, they are realizing this more fully and are being drawn closer together by ties of common interests; but there is not yet the cooperation that there should be in the interests of all concerned. In order to minimize the difficulties of commerce and afford more protection to livestock owners in all countries there should be a mutual understanding and a common basis of action for the exclusion of animal diseases and, as far as practicable, for controlling and eradicating contagious and infectious diseases within a country. There can be no doubt of the mutual advantages that would come from closer cooperation in these matters. With the present development of international livestock trade and the prevalence of destructive animal diseases in various parts of the world, it is suggested that careful consideration should be given to the extent to which uniform laws and regulations by the various countries are feasible, the principal features that should be covered by laws and regulations, the form of organization best adapted to administer them, and, in general, the method for conducting a cooperative protective veterinary service that can be recognized and respected by other countries.

The different conditions that exist in different countries would probably make absolutely uniform regulations for all countries impracticable and perhaps impossible. It should be possible, however, to have uniformity in essential fundamental features and to have cooperation in formulating and administering regulations and exchanging information. A start in this direction was made as early as 1912, when the South American countries which participated in a conference at Montevideo joined in the preparation of a form of international agreement proposed for adoption by the various South American Governments. It seems that such a plan might be extended with benefit to all concerned to include all countries engaged in exporting and importing livestock. This is a matter of growing importance with the increase of international commerce in livestock and the increasing prevalence of disease in some countries.

FUNDAMENTAL FEATURES.

In any international plan which might be adopted, fundamentals are essential for efficient operation. Among the fundamentals which deserve special consideration are the following:

Each country engaged in domestic and foreign commerce in animals and their products, or that wishes to engage in such commerce with other countries, should establish and organize a competent veterinary sanitary service. This service should include laboratories equipped for research work and the most competent research workers should be employed. A country which under present conditions fails to provide such a veterinary service and which continues to receive livestock indiscriminately from other countries would have no right to expect that its animals would be accepted in a country which is endeavoring to protect and foster its own animal industry.

Laws should be carefully framed with the object of preventing the spread of contagious diseases within the country, preventing the introduction of infection from abroad, and preventing the transmission of infection to other countries.

Regulations promulgated under the laws should require that all prospective importers secure permits in advance from the proper government authorities of the country to which animals are to be shipped. Suitable quarantine stations should be provided at ports of entry. Imported animals should be inspected by competent veterinarians immediately on arrival and under some circumstances detained in quarantine for a specified time as occasion requires.

The principal measures in the case of animals for export should be inspection, the administering of certain tests when required, and certification in compliance with the requirements of importing countries, giving official assurance that the animals are free from contagious diseases and have not been exposed within a specified time.

In order that tests such as the tuberculin and mallein tests be conducted by competent persons, only representatives of the government or veterinarians approved by the national livestock authorities should be authorized to conduct them and the charts and other papers should accompany the shipment to destination and be delivered to the proper authorities.

The veterinary service of each country should keep constantly in touch with its disease situation by making thorough surveys at regular intervals to ascertain what contagious diseases of animals and what harmful animal parasites are present in the country and the regions where they exist.

In order to secure the safe, humane transport of animals from one country to another, especially by sea, there should be a uniform standard of sanitation, vessel fittings, and care of animals while in transit.

The livestock sanitary authorities of each country should be provided with sufficient funds and authority to act promptly in controlling or eradicating outbreaks of contagious diseases, especially destructive foreign diseases, when they occur.

The principal features mentioned are already in effect to a greater or less extent in some countries, especially those where the stock-raising industry has been developed. A further step which seems very desirable in view of the increased danger of disseminating disease with the development of international trade in animals, is the establishment of a uniform cooperative international system for an interchange of official information at regular intervals in regard to animal health, the diseases and parasites that exist, the geographical areas involved, and the practices in vogue in regard to importing livestock.

The authorities of a country charged with the protection of such an enormous and intricate industry as the dairy industry would be derelict if they allowed the importation of animals from a country before they were in possession of reliable information as to the health of the livestock in that country. Each country should know also from what countries livestock is being received by other countries and what measures are employed to prevent the dissemination of disease. Canada could not be expected to accept cattle from the United States if the United States admits cattle from a country from which Canada is unwilling to permit importations.

With a veterinary organization in each country to keep in touch with the livestock situation and authorized to keep other countries informed, it could be decided more intelligently from which countries it would be safe to admit livestock. Possibly with such accurate information it would be possible to have more liberal regulations and more freedom of commerce in livestock and animal products than now prevails.

The plan should also include an exchange of information as to whether any efforts are made to control or eradicate disease, the methods employed, and the progress made. The lines of research work conducted and the results would also be of interest to cooperators in the plan. This exchange of information could be conducted directly between different countries, but it would seem more desirable to have it collected and sent out by some central agency, as, for instance, the International Institute of Agriculture at Rome.

The exchange of reliable official information is becoming more and more important with the present rapid development of the livestock industry and the increase of commerce in animals and their products between the different countries of the world. It is time that some organized effort be made to reach an understanding between the different countries interested instead of placing barrier after barrier through regulations to guard against possibilities of infection. Sometimes regulations which tend to hamper or curtail trade could be avoided if importing countries were in possession of more information in regard to the animal health status of foreign countries.

The form and details of the plan suggested might very well be discussed in this conference. The dairy interests of the world represented here are suitably organized to make a move in the direction indicated, and financially they are more deeply involved in international commerce in valuable breeding stock than any other branch of the livestock industry. No doubt such a movement would be welcomed and supported by the entire livestock industries of countries engaged extensively in livestock and dairy pursuits. The United States Bureau of Animal Industry has given some consideration to this matter and would welcome the appointment of a commission consisting of representatives from livestock and dairy countries to consider the matter, to reach an understanding and formulate tentative regulations that would be generally acceptable and which might serve as a model for the different countries which might wish to join in the plan. Such a draft of regulations, in my judgment, should be as brief and simple as practicable and should deal with what are regarded as fundamentals or essentials, leaving details to be developed according to local conditions in the various countries.

PRESENT REGULATIONS OF THE UNITED STATES.

Excellent laws and regulations are already in force in some countries. I will not attempt to discuss the regulations of the various countries, but will outline briefly the regulations now in effect in the United States. These are not offered as a model for other countries or as being superior to those adopted by other governments, but merely as information concerning the means that have been found feasible and effective in one country under the conditions existing there.

The regulations of the United States are based on national laws which provide, in brief, that livestock and their products may not be imported except under regulations prescribed by the Secretary of Agriculture and that animals and meat food products may not be shipped from one State to another except under such regulations. The law also provides for the inspection of livestock and animal products for export.

Under these laws four principal sets of regulations have been issued: (1) Those governing the importation of animals, animal byproducts, hay, forage, etc.; (2) those governing the exportation of animals; (3) those governing the movement of animals from one State to another and providing for the eradication of contagious diseases; and (4) the meat-inspection regulations, which apply to meats for domestic use, for export and for those imported.

The regulations governing the importation of animals apply especially to horses, cattle, sheep, other ruminants, and swine. All such animals upon arrival are subjected to careful veterinary inspection, including, when deemed necessary, certain recognized tests, and most species are detained in quarantine for a sufficient period to determine their freedom from disease. Certificates and affidavits are required giving information relative to the absence of contagious diseases in the region of origin. A record of the tuberculin test is required for cattle intended for dairy or breeding purposes.

The export regulations provide for inspection tests and certification whenever required by the country of destination. They also provide certain specifications for the safe, humane transportation of animals carried by rail or by ocean steamers.

General regulations are in effect governing the interstate movement of livestock. These are supplemented by separate specific regulations with regard to certain diseases, such as Texas fever, scabies of sheep, scabies of cattle, hog cholera, dourine, and tuberculosis. The object is to prevent the spread of these diseases from one part of the country to another through the movement of infected animals and stock cars. In the case of parasitic diseases, such as Texas fever and scabies, inspection, dipping, and certification of animals from an infected region are required with the object of eradication as well as a condition of shipment. Cattle from an area quarantined on account of Texas fever tick infestation are allowed to be shipped in quarantine to specified market centers for immediate slaughter.

At present the United States maintains at Boston, New York, and Baltimore quarantine stations for import livestock thoroughly equipped to accommodate as many as 1,000 cattle at a time. Inspection of import livestock is also conducted at 2 additional Atlantic coast ports, 2 Gulf, and 11 Pacific coast ports, and at 59 Canadian and 10 Mexican border ports. Our regulations are not unduly burdensome under existing conditions and they have proved effectual. Foreign contagions, such as foot-and-mouth disease, contagious pleuro-pneumonia, rinderpest, African horse sickness, infectious lymphangitis, mal de caderas, and nagana have not gained access to this country in the bodies of imported animals since the Bureau of Animal Industry was established in 1884.

In several instances destructive foreign diseases have been detected in animals on arrival at our ports of entry, but they have been prevented from reaching our herds and flocks.

The expense of maintaining a national livestock organization such as the United States Bureau of Animal Industry is small compared with its value in protecting a large industry against its deadly enemies—animal diseases; in fostering the industry through helpful suggestions and demonstrations in farm sanitation and the breeding, feeding, and care of animals; in promoting export trade; in studying the perplexing problems that confront farmers and dairymen; in guarding the public health, and in the confidence its existence and activities inspire in those who are directly and indirectly interested in the livestock and dairy business.

In conclusion, I would urge the establishment of livestock police organizations in countries that are not already supplied with this service, and I desire to emphasize the desirability of action looking to an international plan for an exchange of official information in regard to the status of animal health, and securing the adoption of uniform national regulations so far as practicable governing the exportation and importation of domestic animals and the handling of animal diseases.

Chairman LARSON. It is appropriate that the honorary chairman introduce the next speaker.

Honorary Chairman WALLACE. Mr. Chairman, ladies, and gentlemen: It is my pleasure to introduce Dr. B. M. Anderson, jr., economist, Chase National Bank, of New York City. The subject on which he will address you is, "Agriculture and dairying in the world's economic equilibrium." I take peculiar pleasure in making this introduction because this subject of economics has always been a hobby of mine since I was a boy at school. It also formed the rural economy part of much of my subject when I was a professor—before I retired.

I understand that the world is discovering the force of economic law. Everybody ought to know that economic law governs all human enterprise. The banks now find it necessary to have their economic adviser. Even the politicians find that economics governs their activities. [Laughter and applause.] Agriculture, including dairying, is no exception, and I hope and believe that you will know all about it before our speaker has concluded his address. Let me introduce Doctor Anderson. [Applause.]

AGRICULTURE AND DAIRYING IN THE WORLD'S ECONOMIC EQUILIBRIUM.

Benjamin M. Anderson, Jr., Ph. D., economist, Chase National Bank, New York City.

Mr. Chairman and gentlemen of the World's Dairy Congress: It was a somewhat difficult matter, in contemplation at all events, to prepare a speech that would be of interest to specialists in the dairy industry when I know very little about it. The New York banker has his contacts with the dairy interests, has his contacts with agricultural dairying, including agricultural dairying in very small places, but the contacts are indirect for the most part.

In going through the portfolio of the Chase National Bank some time back I came across a note for $104, signed by John Wilhite and Lizzie, his wife, secured by a chattel mortage on Mollie, Mollie being a mare mule 16 hands high, 5 years old, and broken to single and double harness, resident in the State of North Carolina. Now it is not ordinarily supposed that a Wall Street bank with resources of $500,000,000 would be making very many loans of $104 on mare mule collateral at that distance; but the note was there.

What had happened was very simple. We had made a loan of a good many thousand dollars to a correspondent bank in a rural community in North Carolina and they had sent us, to secure that loan, a stack of collateral a foot high, made up of the small receivables of their local customers with, in many cases, chattel mortgages attached and with the names of the livestock represented by the chattel mortgages in many cases.

We have similar paper from many parts of the country sent in by our correspondent banks. I think that at some time in the year we are lending money through our correspondent banks to farmers in almost every county in the country. In the collateral of these correspondent banks we are very glad to see collateral representing dairy animals. During this troubled period when crop values have been fluctuating widely, our experience has been that those communities where the dairy interest is well developed have a greater stability, the country banks are able to liquidate better, they have a more steady income, and they are a very wholesome element of American agriculture. [Applause.]

The economic world is out of equilibrium. I do not want to go elaborately into a discussion of the political causes, the financial causes, the monetary causes of this breach in the equilibrium, but I want to characterize it in terms of industries rather than in terms of finance.

Production and consumption go on together so long as the balance among the different elements of production is maintained. There is no possibility of production exceeding consumption if the proportions of production are kept right. A supply of wheat comes into the market; well and good. But the wheat also is demand for other things—sugar, silk, cotton goods, automobiles—for other things that the wheat producer wants. A supply of automobiles comes into the market; but the automobiles are demand for wheat bread, for sugar, for clothing, for various things that the automobile producer wants. And so with every other commodity. It is a supply of its own kind but it is demand for other things.

Therefore, viewing the whole economic situation, taking in account all industries in their relation to one another, supply and demand are not merely equal; they are identical, since everything may be looked upon either as supply of its own kind or as demand for the other things.

Now this holds true of aggregate supply and demand. It is not true of particular supply and demand, particular commodities. You may have one thing produced in excess, another thing produced insufficiently—a maladjustment, a wrong distribution of your productive activities, and then the price of a thing that is overabundant will go so low that the producers of that thing are not able to buy at prevailing prices, even the relatively scant product of the producer whose goods are deficient, and his prices collapse too; he can't sell and general disorganization comes.

We witnessed something of this sort in the nineties in this country. We had had, following the Civil War, a very rapid development of the transcontinental railroads and then, following that, an immense pouring of population into the Mississippi Valley. Simultaneously cheap ocean transportation throughout the world had been developed rapidly and great agricultural regions in the Argentine and other parts of the world had come into the markets.

Agriculture during those decades outstripped manufacturing in its rate of growth, with the result that proportions were wrong and agricultural prices fell very low. Then the farmers could not buy.

I remember as a boy, living in the blue-grass country in Missouri, seeing the farmers boiling their wheat and feeding it to the hogs because that was the best use they could make of it. I remember visiting country homesteads and meeting there very gracious hospitality, excellent country food—fried chicken, cornbread, fresh vegetables, good milk, various other of the things that the farm itself provided. But if there were coffee (and there wasn't always coffee), the quality was apt to be poor; the housewife was obliged to use the grounds two or three times. They had no cash to buy "store things," as they called them. They could not always afford store sugar. They would use sorghum molasses at times in sweetening the coffee. The farmers wore straw hats, blue overalls, coarse cowhide boots. The straw hats cost 5 cents in those days—broad-brimmed hats which many of you will remember. When they came to town they had no cash to spend for manufactured goods. There was a crude abundance of local products. Life was not hard except when they thought about their mortgages. There were things to worry about, but there was not a scarcity of the basic comforts.

But there was a reaction of that upon cities. You also remember how city industry was depressed, how there was great unemployment in the cities because the agricultural regions couldn't buy.

At the present time the world, from a very different cause, is in much the same position, although it has not been nearly so severe upon American agriculture this time as it was in the nineties. Formerly Europe was the world's great center of manufacture and the world's great market for farm products and raw materials. Europe's partial withdrawal from this position, leaving the rest of the world producing raw materials, with their raw-material capacity and farm-productive capacity unimpaired, has led again to a breach, a relative excess of raw-material capacity, farm production, and shipping, a relative scarcity of manufacturing activity, with the result that farm products are low in price, manufactured products high in price, out of line, with the further result that the factories alternately have a feverish boom and then reaction and setback, and with the final result that farmers in many lines, and particularly those dependent upon the export markets in this country, are in pretty hard straits indeed, bearing in mind their liabilities and obligations.

The dependence of wheat on the international market is obvious and recognized. Wheat is relatively very low in price, partly because of the unsatisfactory state of European markets and partly because of the increased production in Canada and certain other non-European wheat-producing regions. The situation is intensified by a wheat production in the United States well above prewar levels. In the case of cotton, the unsatisfactory state of European markets is an acutely bearish factor, and if there were anything like normal production of cotton in the United States, cotton would also be selling at a distressingly low price. Bearish foreign factors, however, have been offset in our markets by startlingly bullish domestic factors, primarily by the activity of the boll weevil, leading to very subnormal production of cotton for several years.

Livestock values in the United States, in the Argentine, and in many other parts of the world, are also very sensitive to the European situation. American agriculture, as a whole, appears to be more immediately dependent upon European demand than most other American interests, although copper and certain other raw material interests are also very directly and immediately affected.

Where American agriculture is able to concentrate upon the domestic market, however, its position is much better than where it is obliged to rely largely upon the international markets. Farmers in manufacturing States producing vegetables, fruits, poultry, eggs, and dairy products for near-by cities, are in most cases doing well. In general, to the extent that the American farmer is able to concentrate upon his domestic markets, his position is very much better than where he is largely dependent upon the international markets. The American dairy interest in particular seems to have emancipated itself very largely from the foreign markets. The table which follows shows that our excess of exports over imports of dairy products dwindled to the trifling amount of less than $4,000,000 in 1922, but dairying is so little dependent upon foreign demand, and the power of the American people to consume dairy products is so great, that American dairying remains, on the whole, a prosperous industry despite the demoralization abroad.

Exports and imports of dairy products.

[In thousands of dollars.]

	1919	1920	1921	1922
EXPORTS.				
Butter	17,504	10,142	3,270	4,064
Cheese	5,350	5,054	2,716	1,248
Milk:				
Condensed, evaporated, and powdered	121,893	65,239	37,680	19,464
Other, including cream	1,730	382	480	129
Total	146,477	80,817	44,146	24,905
IMPORTS.				
Butter	4,860	18,646	7,392	2,635
Cheese	4,073	5,657	8,677	14,609
Milk and cream:				
Condensed	2,080	3,332	1,420	3,829
Fresh	1,850	2,702	2,991	
Total	12,863	30,337	20,480	21,063

Moreover, there appears to be ample opportunity for further consumption of dairy products in the United States. The Department of Agriculture states that the annual per capita consumption of whole milk in the United States has been about 43 gallons as compared with about 69 gallons in Sweden, 68 in Denmark, and 67 in Switzerland. The per capita consumption of cheese in the United States has been a little under 4 pounds as compared with 26 pounds in Switzerland, 13 pounds in Holland, and about 12 pounds in Denmark.

The comparison of consumption of milk and milk products in the United States and in other countries must not be taken to mean that we can expect to consume as much per capita as the other countries. To do so would mean that our people would have to dispense with certain other items of food which they may prefer, and which the greater per capita income of the United States makes it possible for them to obtain. The discrepancies are great enough, however, to justify the belief that even moderate price recessions in dairy products would uncover a very great potential demand in the United States and that there is, therefore, no reason to fear that a reasonable further increase in dairy production would break prices much.

The advice to American farmers to turn from the international markets to the domestic markets and, in particular, to increase their activity in dairying, poultry raising, fresh vegetables, and similar things is sound advice within limits. It is especially sound for farmers living close to great centers of population. The most serious difficulty that stands in the way of it is the labor shortage in the United States, growing out of our immigration policy. Unable to get accustomed increases in the labor supply from Europe, our factories have been drawing in labor from the farms, leading to an acute shortage of farm labor in many regions and leading to very high wages for farm labor. Dairying requires more labor than many other forms of agriculture, and it is probable that the most serious limitation upon the expansion of the dairying industry is to be found in the labor situation.

To determine the comparative importance of dairying and other forms of agriculture is not easy. Our agricultural statistics have not been presented in a form that makes direct comparison of the importance of dairying and livestock, on the one hand, with crop production, on the other hand, possible. Both the Department of Agriculture and the Bureau of the Census give us figures of "gross values" of farm products, with subdivisions for the different crops and some subdivisions for animals and animal products. For this discussion I am using the figures of the Bureau of the Census. They are not, of course, such recent figures as are the figures of the Department of Agriculture, and the best I can do is to take the years 1909 and 1919, whereas the Department of Agriculture figures are much more nearly current. The census figures, however, supply more detail for the purpose in hand than do the Department of Agriculture figures.

Gross values of farm products in 1909 and 1919.[1]

[In millions of dollars.]

Kind of product.	Value.	
	1909	1919
Dairy products	596	1,481
Chickens and eggs	509	1,047
Other livestock products	72	138
Domestic animals sold or slaughtered on farms	1,833	3,511
Wheat	658	2,074
Corn	1,439	3,508
Oats	415	855
Barley	92	160
Hay and forage (excluding corn cut for forage)	826	2,316
Cotton and cottonseed	825	2,355
Rye	20	117
Potatoes, Irish	166	639
Potatoes, sweet	35	125
Tobacco	104	444
Other crops	651	2,162
Forest, nursery, and greenhouse products	251	492
Total farm products	8,494	21,426

[1] Bureau of Census figures.

Students will note that the gross values given for 1919 by the Bureau of the Census, $21,426,000,000, are less by about $2,000,000,000 than the figures given for the same year by the Department of Agriculture, whose figures for a series of years follow:

Gross value of farm products.

[In millions of dollars.]

Year.	Total gross value.	Crops.	Animals and animal products.
1914	9,895	6,112	3,783
1918	22,480	14,331	8,149
1919	23,787	15,423	8,364
1920	18,328	10,909	7,419
1921	12,402	6,934	5,468
1922	14,310	8,961	5,349

Students of the dairy industry will also note that the figure of $1,481,000,000 for dairy products given by the Bureau of the Census for 1919 is about $1,000,000,000 less than the figure for the total value of all dairy production which the Department of Agriculture has given us for the year 1921 at a time when dairy prices were lower. The Department of Agriculture figure for 1921 is roughly $2,400,000,000.[1] I am not able, with confidence, to relate this figure to the totals in the table of the Department of Agriculture given above. I can give no confident explanation of the discrepancy between the figures of the Department of Agriculture and the census figures. My guess is that this discrepancy is due to the fact that the figures given in the Bureau of the Census table include only farm products, and not the products of dairies, and that there are some other omissions, such, for example, as the milk, butter, etc., consumed by farmers themselves and the milk fed to animals on the farms, particularly pigs and calves.

I call very special attention to the use of the phrase " gross values " (as distinguished from " net values ") by both the Bureau of the Census and the Department of Agriculture in connection with these figures. This bears very definitely, for example, on current estimates that wheat is only 6 per cent of American farm production. A very gross statistical fallacy is involved if we compare, or if we add together, the value of livestock and the value of crops or compare the dairy products and the value of crops. The value of dairy products and the value of livestock include a very large part of the value of crops, since so much of the crops is fed to livestock and dairy animals. The proper comparison would use only the value added to the crops employed in feeding—raw material—by livestock production or dairy production. This would give us a net figure for livestock production or dairy production, but such a figure it is impossible to get.

Our Government statisticians have not been guilty of this fallacy. Thus the Bureau of the Census says explicitly: " There are many difficulties which stand in the way of obtaining a figure which will represent even approximately the net value of all farm products. * * * The gross value of farm products corresponds approximately to the gross value of products for a manufacturing industry, while the net value of farm products, if it could be obtained, would correspond to the ' value added by manufacture ' which is shown in the reports of the census of manufactures. * * * For many purposes the gross value of farm products forms a very satisfactory index of the progress of agriculture or of the relative importance of the agricultural industry in different areas."

The figure for gross value of farm products, in other words, has certain significance as an index of change from year to year, and has certain significance as an index of the importance of agriculture in different parts of the country. It is not, however, significant cf the actual cash returns to American agriculture, without great modification. It is, moreover, misleading in the extreme when these figures are used simply and directly to determine the relative importance of different kinds of agricultural production.

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[1] Yearbook of Department of Agriculture, 1922, p. 282.

On the basis of gross value figures for 1922, it has been estimated that wheat constitutes only 6 per cent of American farm production. The corresponding figures, based on the census figures above, would show that wheat was about 7.8 per cent of agricultural production in 1909 and about 9.7 per cent in 1919. When the dairy figures in our tables are compared with wheat, they look very substantial indeed, smaller both in 1909 and 1919, but none the less in the same general class. When it is remembered, however, that the dairy values include bran and other by-products of wheat fed to the dairy animals and that they include a great deal of hay, corn, forage, etc., fed to the dairy animals, it is clear that we are dealing with duplications, and that much finer comparisons are needed before we reach a definite conclusion.

Eighty-five per cent of the corn is fed to livestock, 75 per cent of the oats, 70 per cent of barley, and 100 per cent of hay and forage. Cottonseed meal is fed to livestock. Substantial amounts of potatoes and fruits are fed to hogs. A good deal of milk is fed to animals, and in certain tables will appear both in the value of the milk production and again in the value of the animals fed. Poultry likewise makes drafts on various crops. These agricultural figures are thus shot through with duplications, and great fallacies are involved when direct comparisons are made among them in many cases.

Since the able statisticians of the Department of Agriculture and of the Bureau of the Census have felt themselves unable to give us satisfactory figures of net values of farm products and have been obliged to content themselves with giving us (with proper cautions) the figures only for gross values, I shall certainly not attempt to work out net values. I shall content myself with concluding that wheat is very much more important than the 6 per cent figure for 1922 or the 9.7 per cent figure for 1919 would indicate. In general, these figures exaggerate the importance of livestock, poultry, dairying, etc., as compared with crops.

Wheat, although less in value than corn, is very much more important in its own form as a source of cash to the farmer than corn in its own form is, because virtually all the wheat is sold, while 85 per cent of the corn is fed to livestock. The price of corn, in other words, is much less important to the grower of corn than are the prices of hogs, cattle, and other things which he produces with the corn, including milk.

From the standpoint of American agriculture, the great sources of cash are wheat, cotton, livestock, and dairying. Dairying is important, very important. The gross value of dairy products in agriculture is very large, and is a source of current cash. The net values, eliminating the values of the crops consumed in dairying, are much smaller, but are still very large and important. I hope that some of the able statisticians in the dairy industry, who are much better acquainted with these figures than I, will work out for us some net figures, properly comparable with the figures for wheat, which will enable us to put these things in proper perspective. I am not aware of data available to-day which would enable one to do it with precision.

There is one further caution in connection with these agricultural figures. They are value figures, not quantity figures. Obviously, a sharp drop in the value of any given product, as wheat, would reduce the percentage importance to be attached to wheat. It is very curious reasoning which would accept conclusions of this kind, however. If the price of wheat to-day were 33⅓ cents instead of $1 per bushel, the statistical methods I have been criticizing would show that wheat was of very little importance indeed, amounting to only about 2 per cent of our farm production, and the conclusions from this would be that we need not bother at all about the price of wheat. I am not willing to purchase optimism regarding the agricultural situation by means of such statistical devices.

Chairman LARSON. I attended the International Dairy Congress in Stockholm 12 years ago. One other International Dairy Congress has been held since that time. Immediately following the war the permanent federation which conducts the congress was reorganized, and it was not possible under the new plan of organization to invite all nations. Our industry and our people wanted a congress to leave out no one, so instead of conducting this congress under the permanent organization of the International Dairy Federation, our people conducted it as a temporary World's Dairy Congress.

I understand that the permanent organization desires to go ahead and wants the cooperation of the American people. Since two years ago the permanent organization has had other meetings and has changed its policies somewhat. So I am sure that you will all be interested to hear of the present plan of the permanent organization, and it is a pleasure to present Professor Porcher, of Lyons, France. [Applause.]

Professor PORCHER. Mr. Chairman, ladies, and gentlemen: I must beg your pardon for reading my paper in French. I will read it very slowly and I hope that you will understand even more of it than if I tried to present it in English.

LA FÉDÉRATION INTERNATIONALE DE LAITERIE.

CHARLES PORCHER, D. Sc., de l'Ecole Nationale Vétérinaire de Lyon, France.

Depuis 20 ans, les Congrès Internationaux de Laiterie se sont succédés dans les divers pays d'Europe. Le premier fut le Congrès de Bruxelles, qui, comme celui-ci, s'est tenu au début du mois d'octobre de l'année 1903 et qui valut à la Belgique, qui en avait eu l'initiative, l'honneur d'être le siège de la Fédération Internationale de Laiterie créée à cette occasion. Après, eurent lieu les Congrès de Paris en 1905, de La Haye en 1907, de Budapest en 1909, de Stockholm en 1911, et de Berne en 1914. Le succès de toutes ces solennités s'est manifesté de plus en plus brillant et je suis assuré que le présent congrès, si merveilleusement organisé, sera un triomphe.

Tous nous avons été heureux de ce que les Etats-Unis aient fait appel à la coopération de la Fédération Internationale de Laiterie pour réaliser leur grand objet, unissant ainsi fraternellement leurs efforts aux siens pour arriver au but commun: la production d'un lait sain et pur. Il est à espérer que cette coopération fraternelle se continuera dans la suite et qu'il en sortira un nouveau et grand

bien pour l'humanité. Car vous, comme nous, n'avez en vue que le perfectionnement de la production et de l'industrie du lait afin d'offrir à ceux qui le consomment un produit toujours meilleur, toujours plus sain, toujours plus pur.

Vous avez compris que du lait dépend l'avenir de la race, la bonne constitution de la jeunesse. Et la campagne que vous menez avec tant de succès pour faire consommer plus de lait et du bon lait par les enfants de vos écoles a fait notre admiration. La propagande en faveur de la consommation d'un aliment aussi précieux—d'un aliment de vie et de force—devrait être faite dans tous les pays d'une façon intensive, à l'exemple de ce qui se fait chez vous.

La question du bon lait préoccupe actuellement tous les pays. Aussi, je vous félicite de tout cœur de l'avoir mise bien en vedette dans votre congrès. J'espère que tous les savants, réunis si nombreux à ces assises, trouveront la solution qui nous a toujour-préoccupés, c'est-à-dire le moyen de procurer sûrement aux cons sommateurs un lait sain et pur. Faudra-t-il pour cela recourir à des associations libres de producteurs ou de consommateurs? Ou bien les Etats devront-ils organiser le contrôle obligatoire de la production à l'étable? C'est un point essential sur lequel je me permets d'attirer toute votre attention.

Malgré les études et les recherches longues et ardues des savants qui s'occupent spécialment des questions laitières, on ignore encore bien des choses concernant la constitution intime du lait, ses ferments, ses diastases, ses maladies, etc. Je n'en veux pour preuve que les découvertes qui se succèdent encore tous les jours dans ce domaine. Les questions de pasteurisation et de stérilisation du lait sont très controversées. Dans les industries du lait (beurrerie, fromagerie, etc.) il reste encore beaucoup de problèmes à résoudre.

Chacun apporte une pierre à l'édifice, mais celui-ci se construit lentement, sans ordre, sans méthode. Or, Messieurs, tous les retards que nous mettons dans cette construction sont très préjudiciables à la santé et à la richesses des peuples. Car le lait et les produits qui en dérivent représentent une valeur considérable qu'il convient de ne pas gaspiller et peuvent, s'ils s'altèrent, nuire à ceux qui les consomment.

Il nous a semblé que si nous coordonnions les efforts et les recherches des savants, en établissant entre ceux-ci un contact constant, en leur donnant l'occasion de se rencontrer plus souvent, de correspondre, de dresser un programme d'action et d'étude bien déterminé, en faveur duquel nous interviendrions pécuniairement, afin de hâter la solution de tous les problèmes laitiers d'une manière nette et définitive, nous pourrions rendre à tous les pays et à la science laitière un précieux service. C'est dans ce but principalement que nous avons créé l'office international de laiterie dont les statuts ont été discutés et arrêtés par le Bureau Permanent de la Fédération Internationale de Laiterie et vous seront communiqués. J'aime à croire que tous les pays représentés à cette auguste assemblée voudront, pour atteindre le but si élevé de cet office, collaborer à notre œuvre et nous prêter leur concours financier. J'espère aussi que tous ceux qui se vouent à la science laitière nous apporteront leur concours et leurs lumières. Nous ne formerons ainsi qu'une grande famille laitière bien unie, ayant les mêmes aspirations, poursuivant un même but. Que la belle coopération de tous les peuples ici représentés se maintienne dans l'avenir. Travaillons tous ensemble, cordialement unis. De nos efforts communs sortira, comme je l'ai dit en commençant, un grand bien pour l'humanité.

STATUS DE LA FÉDÉRATION INTERNATIONALE DE LAITERIE.

(*Adoptés par le Bureau Permanent de la Fédération dans sa réunion du 8 décembre 1921, à Bruxelles.*)

1. CONSTITUTION.

Article 1.—A l'initiative du premier Congrès International de Laiterie, il s'est fondé une Fédération Internationale de Laiterie dont le siège est Bruxelles.

2. BUT.

Art. 2.—Fédération Internationale de Laiterie a pour but de grouper les associations laitières de tous les pays en vue de travailler au développement universel des intérêts scientifiques et techniques de la laiterie, notamment: (1) en poussant aux progrès scientifiques de l'industrie laitière par la mise à l'étude et la solution des questions relatives à l'hygiène et à la technique laitières sous leurs divers aspects; (2) en prenant l'initiative de la propagande en faveur des mesures législatives propres à assurer la regularité et honnêteté du commerce des produits laitiers.

La fédération s'interdit toute ingérence dans les questions relatives au régime économique des divers pays.

3. MOYENS D'ACTION.

Art. 3.—Pour arriver à ses fins la fédération met en œuvre les moyens suivants:

1. L'organisation de congrès internationaux de laiterie qui se tiennent successivement en divers pays et où se discutent les problèmes laitiers.
2. L'initiative auprès des Gouvernements pour provoquer des conventions internationales, notamment pour décider des mesures à édicter dans les divers pays afin d'enrayer la fraude et d'assurer l'hygiène des produits.
3. L'organisation d'expositions et de concours internationaux de laiterie.
4. La récompense des œuvres les plus méritoires au point de vue de leurs effets sur les progrès de l'industrie laitière.
5. La création d'un office international de laiterie, groupant les stations laitières des pays affiliés à la fédération, en vue d'un travail scientifique commun et comprenant un bureau de documentation et un musée.
6. La publication d'un bulletin destiné à tenir les membres au courant des actes de la fédération et éventuellement d'une revue scientifique signalant les découvertes et les travaux scientifiques, ainsi que les cours et les renseignements divers relatifs à l'état du marché international.

Art. 4.—Des commissions temporaires peuvent être créées au sein de la fédération pour l'étude de questions spéciales.

4. DES MEMBRES.

Art. 5.—La fédération est représentée dans chaque pays adhérent par un comité national.

En l'absence de comité national dans un pays, la fédération peut y admettre des membres effectifs à titre individuel dont les adhésions sont adressées directement au Bureau International Permanent de la Fédération.

En outre, dans tout pays, avec l'agrément du comité national, s'il existe, la fédération pourra nommer des membres honoraires, choisis sans limitation de nombre parmi les personnalités laitières qui ont rendu des services à la fédération; ils sont nommés par l'assemblée plénière réunie à l'occasion d'un congrès international.

5. DE L'ADMINISTRATION DE LA FÉDÉRATION.

Art. 6.—La fédération est administrée par un bureau international permanent qui a son siège à Bruxelles.

Il comprend un président, des membres effectifs et trois secrétaires dont un remplira les fonctions de trésorier.

Les membres effectifs sont désignés par les comités nationaux, chaque comité pouvant nommer un ou plusieurs délégués chargés de le représenter. En cas d'empêchement des délégués attitrés, le comité peut confier sa délégation à d'autres personnalités.

Art. 7.—Le président du bureau international permanent, qui est en même temps président de la fédération, est élu par les membres effectifs du bureau En cas d'absence, il est remplacé par le plus âgé des délégués présents.

Les secrétaries, dont un porte le titre de secrétaire-général, sont nommés par le bureau international permanent lui-même.

Art. 8.—Les membres effectifs ont seuls voix délibérative. Chaque pays ne peut disposer que d'un seul vote.

Art. 9.—Le bureau international permanent est chargé d'assurer la bonne marche des travaux de la fédération. Il fixe notamment l'ordre du jour des assemblées plénières et approuve le programme des questions à porter à l'ordre du jour des congrès internationaux, sur la proposition des comités nationaux chargés de leur organisation.

Art. 10.—Il est constitué, dans le sein du bureau international permanent, un comité exécutif composé du président, de trois délégués dont un belge, et du secrétaire-général.

Ce comité exécutif a pour mission de donner suite aux décisions du bureau international permanent et de régler toutes les questions qui se présentent dans l'intervalle de deux réunions successives de celui-ci. Il dispose à cet effet de l'initiative la plus large, sous la réserve de faire adopter ses décisions lors de la première réunion du bureau international permanent.

Art. 11.—Les décisions prises par le bureau international permanent sont communiquées au premier congrès international suivant.

Art. 12.—Toute modification aux statuts, toute extension ou modification au programme de la fédération doit être votée à la majorité des deux tiers des voix des membres présents.

Toute question portée à l'ordre du jour doit faire l'objet de rapports et éventuellement de contre-rapports, distribués en temps utile à tous les membres du bureau international permanent.

Le bureau international permanent ne peut valablement délibérer que sur les points portés à l'ordre du jour de la réunion.

En cas de parité de voix la proposition soumise au vote est rejetée.

Art. 13.—La langue officielle de la fédération est la langue française.

6. DES COMITÉS NATIONAUX.

Art. 14.—Les comités nationaux sont constitués dans chaque pays suivant les règlements d'ordre intérieur propres à chacun d'eux.

A défaut d'organisation dans un pays d'un comité national, le bureau international permanent peut prendre l'initiative de sa constitution et désigner provisoirement un délégué.

7. DES RESSOURCES DE LA FÉDÉRATION.

Art. 15.—Les comités nationaux prélèvent annuellement sur leurs ressources ordinaires une somme qui est versée à la caisse fédérale et est destinée à couvrir les frais généraux, l'impression et l'envoi du bulletin publié par la fédération, ainsi que les frais de déplacement faits dans l'intérêt de la fédération, par le secrétaire-général, où, à son défaut, le secrétaire qui remplit ses fonctions, sur état visé par le président. Le montant de cette cotisation est fixé par le bureau international permanent à chaque réunion plénière à l'occasion de tenue des congrès internationaux de laiterie.

Dans les pays où un comité national n'est pas formé, la cotisation payée directement au bureau international permanent est de 20 francs pour les membres effectifs individuels et de 100 francs pour les associations laitières.

8. DES MEMBRES.

Art. 16.—Le bureau international permanent se réunit au moins une fois par an, sur convocation de président, pour décider de toutes les mesures à prendre dans l'intérêt de la fédération.

Toutes les correspondances sont adressées au secrétaire-général.

Art. 17.—Le bureau international permanent tient une assemblée plenière à l'occasion de chaque congrès international de laiterie pour voter sur les modifications aux statuts ou au programme d'action de la fédération; se prononcer sur

les décisions prises par le comité exécutif dans l'intervalle compris entre la dernière réunion du bureau et le congrès à l'occasion duquel il est réuni; approuver les nominations des délégués des comités nationaux et délibérer sur toute question dont il pourra être ainsi. Il propose le lieu où doit se tenir le prochain congrès.

9. DE LA DURÉE DES MANDATS.

Art. 18.—Le mandat du bureau international permanent est valable pour le temps séparant deux sessions successives des congrès internationaux. Les membres sont rééligibles.

Chairman Larson. There is a gentleman with Professor Porcher who will give us, in a few sentences, the substance in English, of what we have just heard. [Applause.]

Dr. Ernst A. Hauser (delegate from the Government of Austria). I am not with Professor Porcher; I just happen to know him very well.

Professor Porcher, who is here in the name of the International Federation of Dairy Industry in Europe, wanted to tell you in a few words what they have done in Europe before and since the war. He gave the dates of the dairy congresses held by the International Federation, the first in Brussels, 20 years ago, in 1903; the second in Paris, 1905; the third at The Hague, 1907; the fourth in Budapest, 1909; the fifth in Stockholm, 1911; and the sixth and last a few days before the beginning of the war, in 1914, in Bern, Switzerland. Since the war and the armistice the congress has not been held, and this is the first time that the United States of America has sent out invitations for an International Dairy Congress.

Professor Porcher again read part of the letter from President Maenhaut, of the International Federation, which he presented yesterday, telling you that they all wish that we can begin an International Dairy Federation, as it was before the war; and he hopes that during this meeting many of the scientists will find new ideas and can carry on new research work regarding the constituents of milk and especially regarding the newest science in chemistry, colloidal chemistry, and its developments in regard to milk.

Professor Porcher thanks you very much for the way he was treated here, and he wants me to apologize for him that his English is so bad that he did not dare speak it in English, because you would have understood far less than when he spoke in French. [Applause.]

Chairman Larson. The next subject on the program is "The collection and distribution of milk and dairy products statistics by the International Institute of Agriculture at Rome." To discuss that subject we have Dr. C. Longobardi, chief of section of that institution. Dr. Longobardi. [Applause.]

THE COLLECTION AND DISTRIBUTION OF MILK AND DAIRY PRODUCTS STATISTICS BY THE INTERNATIONAL INSTITUTE OF AGRICULTURE AT ROME.

Cesare Longobardi, LL. D., chief of section, statistical bureau, International Institute of Agriculture, Rome.

Mr. Chairman, ladies, and gentlemen: After what has been said about the necessity of having statistics, especially after what Doctor Mohler has said of the necessity of obtaining them, it is useless for me to say much along that line. All of the speakers have referred to the necessity of having statistical information. You are people interested in the practical activity connected with the dairy industry and so you understand what statistics represent.

I will only say a few words with reference to the International Institute of Agriculture. It was established in the year the treaty was signed, in 1905. Few people realized what this institute could be and would be. The idea of establishing it came to Europe from America. An American citizen came to Europe bringing this idea.

At that time it was very difficult to make people realize what the institute would mean in the progress of humanity. What has taken place since that time has given us such a severe lesson that the results that can be obtained from such work are apparent.

For the second time a new movement is starting here from the United States. Already distinguished American citizens are gathering together and doing work that will help the institute in its work.

When the institute was formed, 45 nations signed the treaty. Each nation was represented by its own government, and all the governments of the 45 countries signed the treaty. At the present time the institute has 62 countries behind it. Each government has its own delegate representing the interests of that country in this immense chamber of agriculture. But to really appreciate this, one must know that these 62 countries represent 97.8 per cent of the total population of the world.

When the institute was first started it established a service of statistical information. It was desired to secure information on production, on trade, and on consumption. It was felt that if the people had reliable, honest information they would know how to arrange their businesses.

The institute then started immediately to organize statistics referring to agricultural production, giving principal attention to cereal production and to cotton production. In this field the institute has already arranged a very important service, and this work is now going along on such established lines that its great importance is generally recognized. This year the institute has been able to extend its telegraphic service of information on crop production and crop conditions. When the institute was founded, some countries, as, for instance, Italy, organized their statistics for the purpose of answering the request of the institute. Notwithstanding such improvement, in May of 1911, the institute could give information on area sown and condition of wheat for only 11 countries. In May of this year the institute gave similar information for 25 countries, being practically all the important agricultural countries. We receive regular telegraphic information from 25 countries, and other information from all the other countries of the world.

You will realize that the work that the institute has to do is immense if you consider that the institute represents all the agricultural interests of all the countries of the world. Every country has its own permanent delegate in the institute, representing the interests of his own country.

The following report has been prepared for you by the institute:

MILK STATISTICS AND THE INTERNATIONAL INSTITUTE OF AGRICULTURE.

1. One of the chief duties of the International Institute of Agriculture is the centralization of statistics of agricultural production. In order that this duty may be properly fulfilled, the institute must

use its influence not only in inducing the various governments to collect the necessary data, but also by following out in so far as it is possible, similar methods and forms of statement.

Good work has already been done in this connection. The organization of international agricultural statistics has been considerably improved and rendered more and more complete during the 14 years of the institute's activities. Especially is this true in those particular branches to which the major portion of the institute's attention has been directed, viz, crop production and livestock.

2. As far back as 1914, it was considered desirable that the institute should extend its sphere so as to include statistics of the dairy industry. The subject was included among those submitted to the general assembly in 1913. Because of the war, however, it was only possible to make certain provisional and partial inquires. A preliminary account of the existing statistical material on milk and dairying appeared in 1919, in one of the publications of the institute.[1] A later publication gave a conspectus for a considerable number of countries of the data for the trade in cattle and cattle products.[2] Moreover, the general assembly of 1920 recommended that the governments should provide annual statistics as to the number of cattle according to a form of classification, which distinguished milch cows from other categories of cattle. This recommendation was intended to facilitate the preparation of estimates on milk production in the different countries.

3. To-day the subject is again being considered by the institute as a whole. The statistical department is conducting a study along three main lines:

(*a*) The collection of the statistical material already available in the different countries, (*b*) the consideration of the statistical methods adopted in the countries where statistics are collected, and (*c*) the consideration of concrete proposals to be submitted to government departments, tending to secure in the various countries a regular system of statistical information on milk production. It is desirable that this information should be based on a uniform and appropriate method in order that the institute may include the figures in its regular service of statistical information.

The results of these studies will probably be brought before the general assembly at its meeting in Rome in the spring of 1924. Although the question presents serious difficulties, the institute is confident that its efforts will be successful, and that its work, the value of which is already acknowledged in other branches of agricultural statistics, will be found to be valuable also in this important sphere.

The question of more complete dairy statistics can not fail to be of vital interest to those connected with the industry, who in each country will enjoy all the advantages which accrue from a better knowledge of the position of milk production in their own and other countries.

On the other hand, the organization of any form of statistics on milk and dairying presupposes an effective cooperation on the part of the industry. It is for this reason that the institute considers it desirable to acquaint this congress with its proposals, in the hope that it may acquire new incentives for the work that it has already begun in extending the collection and compilation of international dairy statistics.

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[1] Documentary Leaflet No. 2, 1919.

[2] Commerce International du Bétail et de ses Dérivés, Rome, 1921.

The following notes and comments are intended to give an idea of the various factors already available to-day and to show how a regular service of milk statistics may be organized and developed:

AVAILABLE STATISTICAL MATERIAL.

1. Complete official figures on milk production and dairying are regularly supplied by a very limited number of countries. The United States included inquiries as to the amount of milk, butter, and cheese produced during the year preceding the census, in the schedules distributed to all farms on the occasion of the censuses of 1890, 1900, 1910, and 1920, and Canada did the same for censuses in 1910 and 1920. The census made in Brazil in 1920 required the individual farmers to supply figures for the quantities of milk and cream sold and butter and cheese produced. Australia makes an annual return of the output of milk and dairy products within the Commonwealth. In Holland censuses were made of butter and cheese production in 1903, 1906, 1910, and 1912 but were suspended as from the latter date. Annual returns of milk and dairy production are now made in Japan as the result of a recent statistical order; similar returns are also made in Chile for milk production and in the Union of South Africa and in New Zealand for the output of dairy products.

2. In other countries public authorities have occasionally collected similar statistics, which however often refer to comparatively distant dates. In France, for example, statistics of milk production were obtained for the year 1902, when the department of agricultural information was engaged on a far-reaching inquiry into the situation of the milk industry at home and abroad.

In Great Britain the inquiry into the "Agricultural output of Great Britain in 1908–09," made in connection with the "production census," included the milk production for the period of 12 months ending on June 4, 1908.

3. During the war the exceptional requirements caused by prevailing conditions encouraged the undertaking of special inquiries. In the United Kingdom, for example, a "committee on the production and distribution of milk" was set up in April, 1917, which, among its other activities, attempted to ascertain the general position of milk production during the war period as compared with the average for the years 1909–1913. In Germany an inquiry into the national milk production was made by the Prussian Ministry for the Interior in 1915, and during the last years of the war a complete organization was established for providing figures each month as to the amount of milk produced, in order to allow the rationing of dairy produce. Estimates are therefore available for the production of milk in Germany for the war period.

4. Inquiries, often of considerable value, have also been made at different times and in different countries by societies and private individuals with the object of obtaining, either by means of information already available or as the result of special study, an estimate of milk and dairy production in their respective countries. In this

connection the work carried out in 1903 by a special committee nominated by the Royal Statistical Society of London deserves mention. Its terms of reference were "to inquire into the statistics available as a basis for estimating the production and consumption of meat and milk in the United Kingdom."

Reference may also be made, inter alia, to the estimate made for Switzerland by the Swiss Peasant Secretariat; for Germany by Kirchner, Kuczinsky-Zuntz, and Semler; for Italy by Professor Besana; for Sweden by Haglund; for Hungary by Koerfer, etc.

5. There already exist in certain countries partial statistics on milk and dairy products or at any rate such indirect information as is contained in the data supplied by producers' organizations, cooperative dairies, establishments manufacturing butter, cheese, and the like, municipal returns, etc. Canada, the United States, and Argentina give annual returns for the output of dairy products in industrial establishments or factories, excluding the produce on the farms themselves. Sweden publishes full annual statistics of dairy work (number of dairies, amount of unskimmed milk produced, amount sold, amount of cream sold, and cheese and butter produced). Norway supplies every year the amount of milk handled in the dairies and condensed milk factories, and Finland gives figures for the butter and cheese manufactured in the dairies. Denmark on the other hand publishes figures for a large number of dairies, indicating the number of cows and the average annual milk output per cow, etc. In Holland the annual amount of butter produced under the surveillance of the control stations is ascertained. It is also possible to obtain periodical statements of the amount of milk and dairy products that are brought in to certain large urban consuming centers such as Paris, Vienna, New York, Montreal, etc.

6. Finally and on the international side, reference should be made to the information collected every quarter by the office of prices information of the Swiss Peasants' Union, concerning the position of the output of milk and dairy products in different countries. By arrangement with several official institutions and a large number of farmers' associations in different countries this body collects, in addition to information on the forage situation and the prices of milk products, figures showing the changes in milk production as compared with the figures for the corresponding periods in the previous year. These are expressed by means of the following index figures: 0=no change, —1 to —3, slight, marked, very marked decrease, +1 to +3, slight, marked, very marked increase.

THE POSSIBILITY OF DEVELOPMENT IN THE ORGANIZATION OF MILK STATISTICS.

1. While, as suggested by the above summary, statistics on milk production and dairy produce are available for a certain number of countries, it must be recognized that in the majority of cases the figures appear at irregular intervals or are incomplete and obtained by different methods and are in any event insufficient to serve as a basis for an international statistical service such as the institute has provided for several years for a quite considerable range of crop products.

The special difficulties that arise in connection with the question of a regular system of statistics for milk production explain the position of general inferiority of this particular section in comparison with other branches of agricultural statistics. We may here consider the possibility of its development along uniform lines.

Granted the importance of cow's milk and its derivatives, from the point of view of world production and consumption these particular products will for the sake of brevity be mainly considered. It should, however, be understood that whatever may be said with reference to cow's milk and its derivatives will be equally relevant for sheep's milk and goat's milk and their derivatives for all countries in which these products are of any considerable importance.

2. A knowledge of the amount of milk produced in each country may be reached either directly, by obtaining from the individual dairy farmers returns of the amount of milk produced by their herds for a given period and available for human consumption, either as such or after transformation into dairy products; or indirectly, through an estimate based on the number of milk cows in the country during the given period and the average amount of milk produced per head during such period. The first system is followed by some of the few countries which make a regular census of production; these include in the list of questions sent to the farmers for the purpose of the census a heading for the amount of milk produced on their farms. This system is the one that in general gives the most satisfactory results. It must not, however, be assumed that this form of direct information presents no special difficulties. As a matter of fact an exact registration of milk production can only be made for the more highly organized farms, whereas elsewhere the producers can merely provide an estimated and approximate figure. In this connection it is interesting to note that in the United States a certain number of farmers who reported dairy cows on the census date failed to report any milk production for the preceding year so that the production of their dairy cows had to be based on the average production per dairy cow as shown by the complete reports.[3] But, speaking generally, producers should be in a position to give a sufficiently accurate estimate of the amount produced by their own animals. It is certain that direct returns give the surest basis for a knowledge of milk production; even if there are good reasons for not obtaining annual figures, this method should in any case be adopted when a census is taken.

Unfortunately the practice of making censuses at regular intervals has hitherto only been adopted by a very limited number of countries. The institute lays great stress on the general adoption of the system of making censuses of production as far as possible at uniform dates and along uniform lines. Such censuses should include milk production among other categories.

3. Apart from the direct returns, which, on account of the amount of labor and expense involved in a census taking, can as a rule be made only at relatively infrequent dates, estimates of milk production can also be made indirectly on the basis of the number of milk cows and the average yield of milk per cow. This method, at first

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[3] For the census of 1920 the amount of production thus estimated represented 12 per cent of the total.

sight resembles dingly that followed very generally for the valuation of a particular crop production in which an estimate is made on the basis of the area sown and the average yield per acre for each zone. A closer study of the parallel brings out, however, the greater difficulties in practice of making estimates of milk production.

The growth of any particular crop and the condition of such crop just before the time of harvesting (or, in other words, the forecast of the yield per acre) are matters that within the limits of a determined area can be estimated with a reasonable degree of accuracy by one or more observers. The reporter, after a survey of his district and a careful examination of the fields where the crop is ripening, is in a position to form an opinion of the probable extent of the yield for the area. The estimate has an element of security by reason of the fact that it is based on what is actually visible and can be readily translated into figures by an expert. Moreover harvesting takes place once a year only and practically all at one time for a given area; hence a simple estimate made on a single occasion covers the whole of the production for the area and crop under consideration.

On the other hand, in the case of milk the question is one of a continuous product collected from day to day. Not only is the production distributed over a wider period, but also more diversified than is the case with crops. It is impossible to have a knowledge of the actual number of milk cows and still less of their average annual output on the same basis as, for example, for an area sown with wheat and for its average yield for a given section, by means of the direct observation of an expert. It is necessary (in the case of milk), in order to get really accurate knowledge, to make special inquiries of a far more complicated and difficult order.

4. It is necessary that every country should possess annual figures for the number of milk cows. As stated above, the institute has already considered this question and brought it to the notice of the governments.

The general assembly, in 1913, approved unanimously the following recommendations which were forwarded to all the adherent governments:

> The general assembly is of opinion that both in the national and international interest it is absolutely necessary that each State should possess statistical returns for livestock. It hopes that in countries where such statistics either do not as yet exist or in which they are not organized in such a way as to be able to satisfy the requirements of a service of international information, the necessary steps may be taken as soon as possible to establish such statistics in accordance with the recommendations made by the institute.
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> The general assembly is of opinion that statistical returns for livestock should show as far as possible for each year the number of head of each kind and for each of the categories set out in the subjoined recommendation.

These recommendations were confirmed at the general assembly of 1920, which in addition expressly introduced into the classification of the various types of cattle, a special heading for milk cows, justifying the insertion by "the great importance attaching to a knowledge of the figures as an indispensable element in an estimate of milk production."[4]

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[4] Acts de la Cinquième Assemblée Générale, Tome II, p. 292.

5. At the present time the countries which have annual statistics for cattle are the following (names of countries in which these statistics are not made with absolute regularity each year are printed in italics and a certain number of countries and colonies of quite minor importance are omitted):

Argentina, *Algeria*, Austria, Australia, Belgium, Bulgaria, Canada, Chile, *China*, *Cuba*, Denmark, Egypt, Esthonia, Finland, France, Germany, Great Britain and Ireland, *Greece*, India, Japan, Korea, Latvia, *Luxemburg*, Madagascar, Morocco, Netherlands, New Zealand, Norway, Philippines, Rumania, Siam, Southern Rhodesia, Spain, *Sweden*, Switzerland, *Tunis*, Uganda, Union of South Africa, United States.

The number of these countries is considerable, and among them are to be found some which are specially important as regards milk production and yield in dairy products. The number of countries which have adopted a special heading for milk cows in their classification is a good deal smaller,[5] while others merely give a general figure for cows or an indication of the total head of the various kinds of cattle. The following table shows the type of classification employed in the countries referred to above.

Countries with annual statistics for cattle.

Showing the number of milk cows.	Showing the number of cows in general.	Without indication of the number of cows.
Australia.	Algeria.	Argentina.
Belgium.	Austria.	Bulgaria.
Canada.	Cuba.	Chile.
Germany.	Denmark.	China.
Great Britain and Ireland.	Egypt.	Greece.
Japan.	Esthonia.	Korea.
Luxemburg.	Finland.	Latvia.
Netherlands.	France.	Madagascar
New Zealand.	India.	Morocco.
Rumania.	Sweden.	Norway.
Spain.	Switzerland.	Philippines.
United States.		Siam.
		Southern Rhodesia.
		Tunis.
		Uganda.
		Union of South Africa.

Although a certain number of important countries already possess annual statistics of milk cows, there are still many in which this fundamental element for estimating milk production is lacking. It may be noted, however, that in recent years some progress has been made in this respect. Spain and Rumania have lately introduced a heading for milk cows into their annual statistics. Certain countries recently constituted, such as Czechoslovakia and Poland, have already taken into account the recommendations made by the institute, in connection with the classification adopted in their latest censuses of livestock, and it is to be hoped also in their subsequent annual statistics. The continual pressure brought to bear by the institute is tending to bring about a similar acceptance by all the governments.

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[5] It should be noted that the term "milk cow" should have in the statistics of all countries a uniform definition and significance so as to include all the individuals which for the year to which the figures refer either are actually giving, have given, or are likely to give milk either for direct consumption or for conversion into derivatives, excluding those whose milk is used solely for the nourishment of calves.

6. As regards an estimate of the average annual production of milk by the milk cows of any particular country, the available material is still more scanty.

The average milk production per head of cattle in any given country is the result of a great variety of factors, some of which show relatively little variation from one year to another (e. g., breeds, management, etc.), while others (e. g., alimentation, health conditions, etc.), vary considerable. These factors bring about considerable differences in the average annual production for each individual cow in the same country and for the same individual from one year to another.

Ideally, in order to arrive at a sufficiently accurate annual estimate of average milk production for the total head of milk cattle in any country, it would be necessary:

(*a*) To ascertain approximately, in addition to the actual numerical distribution of the milk cows in the various districts of the country what is the proportion for each district of the different groups classified by breed, age, etc. Since these proportions are not likely, as a rule, to show any great changes from year to year, it would suffice that they should be established as a result of information obtained on the occasion of the census taking or by means of a special inquiry at relatively long intervals.

(*b*) To make a reckoning for each year for each district by means of estimates or partial returns of the average milk yield[6] for the year in question for each group.

With this material available it would be possible to calculate the average production per head for each district and for the country as a whole.

7. Subject to the above, it must be recognized that at the present time the preliminary material required for annual statistics for milk production per head is insufficient in the case of almost all countries or is altogether absent. Among the very few examples of classification by breeds, mention may be made of an inquiry into the distribution of cattle according to breed made in the United States in 1920 by the Bureau of Markets and Crop Estimates, and the information obtained in connection with the inquiry into the dairy industry which was carried out in France in 1920. Inquiries into average annual yield per head are made in certain countries, where the dairy industry is most advanced, by the control societies, but although these societies have been greatly developed in recent years and their work may be of value for purposes of statistics, the actual number of cattle which come within the range of their observation is still relatively small. In addition, the fact that the controlled cattle are almost always selected and above the average from the point of view of production makes it dangerous to draw any general conclusions from the results obtained from the controlled cows as to the facts for the total number of milk cows in a particular country.

8. However, by making use of the actually available material and the facts already ascertained and completing them by means of an

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[6] Leaving, of course, out of account the amount of milk used for feeding calves.

appropriate organization, it appears to be by no means impossible, in any case in the states where the dairy industry is of considerable importance, to obtain regular returns for the various elements which require to be known in order that an annual estimate of milk production may be made. The concrete solution of the problem depends upon general conditions (e. g., administrative arrangements, institutions already in existence, the particular type of dairy industry, etc.) which vary with the different countries. Hence it is impossible to lay down any general rules as to practical methods of obtaining the necessary data such as would meet the case of every country. It must suffice to state that the willing and whole-hearted cooperation of milk producers and their associations in the matter of the provision of the figures is an indispensable condition of success for any proposed action in this direction.

When annual estimates of however rough a character are supplemented by census takings at less frequent intervals, it will become possible to check results and in consequence to effect improvements in method so as constantly to be making a closer approach to the actual facts.

9. The yield of dairy products (such as butter, cheese, condensed milk, etc.), can be readily ascertained by direct returns in connection with censuses of production. It should not be difficult to organize annual statistics, such as are already in existence in certain countries, of the amounts produced in establishments of the industrial type. It is, however, considerably more difficult to obtain figures from year to year of the yield of dairy produce on the farms themselves.

In any event, a knowledge of the actual extent of the milk production affords a sure guide for forming an opinion as to the position of the output of dairy products. Hence, in the first instance at any rate, it appears to be desirable to concentrate chiefly on efforts to secure the establishment of annual statistics of milk production for the different countries.

CONCLUSIONS.

1. To sum up, all countries, or at least all those in which the milk industry is specially important, ought to develop the organization of regular statistics of milk production. Where such statistics can not be established on the basis of direct annual censuses, they should at least include:

(*a*) A census taken at regular intervals, for example, every 10 years, which should enumerate the actual quantities of milk produced and of dairy products.

(*b*) An annual valuation of milk production obtained indirectly on the basis of the actual number of milk cows and the annual estimate of yield per head.

Statistics similar to those recommended in the case of cow's milk should also be established for sheep's and goat's milk and their derivatives in countries where their production is of any considerable importance.

The International Institute of Agriculture would arrange for the collation and distribution of all the statistical information thus collected from the respective governments.

2. This scheme can only be carried out gradually and as the result of special efforts by reason of the undeniable practical difficulties which have to be overcome. But the resultant advantages are so obvious and of such general interest that the institute is confident that it will be able to persuade the adherent governments to put it into practice for their own countries and that it will also have the support of dairy farmers and the dairy trade.

By the terms of its constitution, the International Institute of Agriculture is charged with the duty of serving with the governments as interpreter of the recommendations made by international congresses.

The institute would therefore be glad if, in bringing the question of milk statistics before the next meeting of the general assembly, in 1924, it might be in a position to state that it is at the same time giving expression to the recommendations which the congress will be formulating on the subject.

Chairman Larson. It was announced at the beginning of this session that, according to ruling, when the regular speaker was not present it was necessary to move the paper to the end of the program. We have now arrived at a time when that paper is in order. We have here to present Doctor Taylor's paper his associate, the assistant chief of the Bureau of Agricultural Economics of the United States Department of Agriculture, and I would like to know the opinion of this delegation as to whether he should be heard at this time. Are there objections to hearing from Mr. Tenny on "International trade in dairy products"?

(The members applauded, indicating their desire to hear Doctor Taylor's paper).

Mr. Tenny. Mr. Chairman and gentlemen: If you do not appreciate now that Canada and the United States are of one mind, you will after I have read Doctor Taylor's paper. It is very interesting to see how two people thinking along the same lines reach pretty nearly the same conclusions.

(Mr. Tenny then presented Doctor Taylor's paper.)

INTERNATIONAL TRADE IN DAIRY PRODUCTS: SIGNIFICANT TRENDS OF SUPPLY, DEMAND, AND PRICE.

Henry C. Taylor, Ph. D., chief, Bureau of Agricultural Economics, United States Department of Agriculture.

Dairy products are entering international trade in increasing volume and the prices of dairy products everywhere are increasingly influenced by world conditions. In the 40 years preceding the World War the quantity of dairy products entering international trade had increased fourfold. In 1922 the total volume had recovered to fully 20,000,000,000 pounds in terms of their estimated milk equivalent, or practically to pre-war volume. Dairy products are now imported into the United Kingdom, by far the most important importer in the world, in greater volume than ever before. According to official estimate, imports of all dairy products into that highly industrialized country are now equal to 54 per cent of the total consumption in Great Britain. Approximately three-fourths of its total supply of butter and of cheese is imported.

The present significance of foreign trade for certain exporting countries is equally apparent. Denmark, as you know, now depends upon foreign demand for roughly nine-tenths of its butter output, Argentina for three-fourths, and New Zealand for the principal part. Of the cheese-making countries, the Netherlands now depends upon sale abroad for approximately two-thirds of its output, Switzerland two-fifths, Canada nine-tenths, and New Zealand, again, for all but a minor part.

The mere volume of exports or imports from year to year may yield a superficial analysis of the world situation as it affects the dairy industry at any particular time and place. But it is important that the trade is already sufficient to place dairy products in the first rank among those staple agricultural commodities for which the market is a world market.

Comparison of prices actually paid in various important markets of the world shows conclusively that a world price level prevails. Prices in any one country can not get far out of line without inducing international shipments that are profitable to importers and exporters. The closeness of the relation between monthly average prices of butter as they prevailed in important markets in Germany, Denmark, Great Britain, and the United States during the 10-year period just preceding the war is more effectively shown by comparison of price trends in three of the principal dairy markets in the United States during the same period. Temporary variations in both groups serve only to emphasize the persistent tendency toward adjustments between markets. Dairymen the world over are rubbing shoulders with each other in competition in virtually one great market.

Recently improved transportation facilities, modern methods of preserving milk, and extension of market news and information have made possible a great expansion of the international trade in dairy products. Transportation improvements affect both quantity and quality of shipments. A single ship recently carried a cargo of 3,600,000 pounds of butter from Canada to England. Refrigeration has made possible the transportation of fresh milk across the American continent and from South Africa to England. Now the report reaches us that "by means of the proposed Harwich-Zeebrugge train ferry it is hoped to place continental produce in London sooner than from the English countries. It is stated that even liquid milk may be imported by this method." At the present time butter can be shipped to New York City more cheaply from across the Atlantic than from some of the best dairy sections of the United States. In fact, the relative cheapness and efficiency of water transportation is coming to be widely recognized and may be expected to play an increasingly important part in determining channels of trade.

Processes of preserving milk through partial or total dehydration have facilitated international trade. By means of such treatment the equivalent of more than 2,000,000,000 pounds of milk was exported from the United States to Europe in 1919. Improvement in means of communicating market news may be expected much further to promote commerce in dairy products on an international scale.

Certain developments, on the other hand, tend to check or diminish the need for international trade movements. One of the most effective checks upon the development of foreign trade in dairy produce is the established systems of cold storage such as have grown up, especially in Canada and the United States, by which domestic supplies are regularly stored from seasons of heavy production to seasons of light production. Ireland, while without extensive cold storage, was normally importing butter during the winter months at the same time that nearly 100,000,000 pounds were being exported every year.

While the total milk production is nearly the same in Great Britain as in Canada, the former imports, in addition, an equal quantity in the form of various milk products, while the latter still exports about one-fifth of its total production. The growing industrialism in Canada with its consequent increase in home consumption is already tending toward the lessening of the exportable surplus in that country simultaneously with an increasing total dairy production.

Another influence of recent origin is the imitation of particular varieties, especially of cheese, that have found sale in foreign countries. Swiss, Camembert, Limburger, Roquefort, and certain Italian varieties, by means of scientifically controlled conditions of manufacture, have been imitated in this country. Swiss cheese, especially, is now manufactured here on a commercial scale.

A striking development, significant for all countries concerned in the world's dairy industry, is shown by a classification by countries as exporters and importers, according to the rank of each as they were just before the World War and as they are to-day. Sources of surplus have made a marked shift from countries of the Northern Hemisphere to countries of the Southern Hemisphere. Before the war the United Kingdom received just one-fourth of its imports of both butter and cheese from the Southern Hemisphere. In 1922, somewhat more than one-half was received from New Zealand, Australia, Argentina, and South Africa.

The chief significance of this shift undoubtedly lies primarily in the resulting change in the seasonal trend of butter imports into that country. The seasonal fluctuations of production in the one hemisphere, of course, naturally complement those in the other, with the result that if supplies for a great importing country such as Great Britain were drawn equally from both regions, the supply throughout the year would tend to be rather uniform. However, that very important part of the supply which comes from Denmark has, as you know, been adjusted to a remarkably even flow from month to month throughout the year. The seasonal trend of supply on the British market was deemed of sufficient importance by the Danes to justify them in turning to winter dairying in order to profit by the relative scarcity and higher prices prevailing in that season. At the same time, supplies from Russia, Sweden, and France were normally heaviest in summer. Now that Russia is practically out of the trade, and supplies from Sweden and France are meager at best, a strange situation has arisen, in which there is actual scarcity in the summer months and early fall, before supplies from Australasia reach the British market.

As a result, the British butter market, during the last few years, has been without its pre-war stability because, as yet, there has been no such adjustment to the new supply trend as made for such remarkable stability before the war. The anticipation of shortage of supplies in the summer and early fall has thrown something of a speculative element into the butter market there. This is further demonstrated by the tendency recently observable for prices of butter to move less in sympathy with prices of cheese in the British markets than previously. This is what we should expect if the seasonal supply of butter is being subjected to a shift while cheese supplies remain uniform. And we know it is true that, in the cheese trade, Canada and New Zealand not only complement each other in seasonal shipments to the United Kingdom, but even in the matter of quantity the imports from Canada just about balance those from New Zealand.

This tendency toward higher summer prices in the British dairy markets raises the question as to what influence it may come to have on the dairy world aside from its direct effect on the British and Irish producers. The possibility is not to be overlooked, of placing large quantities of butter in cold storage in Great Britain during seasons of heavy supply, to be withdrawn and placed on the market in those months in which prices tend higher. But the well-known preference of British consumers for the fresh products that have been brought to their door the year round from the Empire farm and from the Continent, is a fact to be reckoned with in studying the possible advantage or disadvantage to exporters, in different countries, in supplying the demand. It is possible to trace some of the effects of this shift into other countries, such as Denmark, the Baltic States, and the United States.

Danish farmers would seem to us to be in a peculiar position. The winter prices, to which they long ago adjusted production by turning to winter as well as summer dairying, are now depressed by heavier supplies produced by farmers in Australia, New Zealand, and Argentina in their own summer season. On the other hand, the summer prices, to which they might have adjusted production along lines of less resistance had they been sufficiently remunerative, are now raised by the scarcity of supply from their competitors in that season. But a system of agriculture like the Danish is not to be changed overnight. If it were, the growth of dairying in northern sections might later swing the balance again. Nor is the conscious advantage to Danish producers in having their fresh butter available to their customers in uniform quantities the year round to be sacrificed lightly. Rather we would expect any Danish adjustment to take the direction of continuing to seek other alternative markets, and possibly even to turn, seasonally at least, to greater production of cheese and other milk products.

It is probable, too, that this outlined situation may prove fortuitous to farmers in those promising dairy countries of northern Europe—Finland, Esthonia, Latvia, and Lithuania—which, with dairy resources similar in some respects to those of Denmark, are quietly emulating that veteran dairy country, and are to be regarded as having possibilities not to be ignored in the future development of the world's dairying. Finland, the furthest developed of the group, before the war was exporting 26,000,000 pounds of butter annually. Butter from the Baltic States is now appearing on the British markets as a reminder of the pre-war Russian sources. Farmers of these countries look forward to turning to intensive dairy farming with feed imported from Russia and are closely studying the famous methods of farmers in Denmark.

From the point of view of the United States, this recent far-reaching change in seasonal supply and price serves to raise into greater prominence the whole economic question as to the possibility, that, in the course of future developments, mutually advantageous seasonal trade in fresh butter may assume such proportions as to replace, to some degree, the system of seasonal storage that grows out of a local or national economy.

This shortage of supply in Great Britain is now almost simultaneous with the movement into cold storage in the United States. Will it be found profitable to dealers in the United States to sell in the British market during its summer strength just as it has been to buy and hold for the next winter's high prices at home?

Already the season of shortage is anticipated each year in the British markets, and each summer since the shortage appeared there has been some flurry in the American markets, even though the quantities actually shipped thus far have been comparatively small.

If the American exporter could thus sell fresh butter in a market that puts a premium on it because it is fresh, would he do as well to store it for the seasonal rise in domestic prices when he knows there will be a certain amount of deterioration in quality? The best grades of butter are the ones that best stand storage, just as they would best encourage foreign demand.

Butter that has been in cold storage 30 days or more is sold in the United States as "held butter." During the past seven years held Creamery Extras sold in New York at prices averaging approximately 4 cents per pound lower than prevailing prices for the same grade of fresh butter. There is certainly involved in this situation the possibility that the relative profitableness of winter and summer dairying will be affected. The question is at least raised for consideration as to whether winter dairying is to be encouraged in each country or whether a leveling of prices throughout the year is to be the answer to such a proposal.

An exchange of butter is all that is here suggested, for it is not assumed that the United States is to develop into a surplus butter-producing country. In fact, unless economic pressure causes the United States to sell most of its best dairy products abroad rather than what is left after the home trade has bought the best, we need not look forward to a high place in the rank of exporting nations. So long as we are able to consume all of our best at home, the home market may also attract supplies of high grade butter from other countries. Such a tendency would result in the United States importing butter and cheese on a larger scale than they are exported.

Too much time, however, must not be given to the discussion of the industry in the United States however closely it is felt that our industry is tied up with that in other parts of the world. Certain outstanding developments within some of the individual countries that are influencing international trade, and thereby the dairy interests of other countries, must be touched upon, if only very briefly.

Russia, as we know, was recently the second largest exporter, with a pre-war export of 150,000,000 pounds annually, half of which went to the United Kingdom. Since the war, in attempting to answer the question as to when Russia will come back into the world's butter market, little could be said, or can yet be said, with certainty. Soviet statistical sources indicate, however, that the actual decrease from the pre-war total number of cattle in Russia, including Siberia, has not resulted in a proportionate decrease in the number of cows. This can be accounted for, of course, by the fact that the cow afforded food resources for immediate consumption, and not for production in the future only. Siberian butter is just now again making its appearance in small quantities in the London markets.

Offsetting Russia, in a sense, is Germany, which in pre-war years was the second largest importer of butter, with an annual importation of 111,000,000 pounds. Germany is now buying abroad negligible quantities of butter and is using various substitutes for butterfat—first, other animal fat; then, still cheaper vegetable fat. That country continues to import cheese, for which there is not the same opportunity for substitution, but Germany will be out of the foreign butter market, for how long we can not know. Increasing home production in Germany may be expected under present conditions. In 1922, production of butter in Germany was 66 per cent of pre-war volume. There is now a tendency in that country, as in Russia, to retain milk cows on farms, and the feed supply is reported as increasing.

New Zealand, the new star in the dairy firmament, is now seen by some as of the first magnitude. Even to observers with a different point of view, it is now recognized as of no less than second magnitude. Its ascent has been spectacular. Twenty years ago the surplus of dairy products from that little island was negligible. Now it is by far the greatest single source of supply for the United Kingdom, and, next to Denmark, New Zealand is now the largest exporter of dairy products in the world. Its resources make it primarily a dairy section, and its population is small and principally agricultural. Although the circumstances of the war period gave great impetus to New Zealand's production of dairy products for export, this development is certainly permanent. This year will not show any such increase, to be sure, as the last season displayed. The director of the dairy division in Wellington tells us that the dual factories in New Zealand will turn to cheese this year and that, given an ordinarily favorable season, cheese production will probably increase by 10 per cent and the butter output will equal that of last year. The same authority estimates that the next 10 years may see a total increase in dairy products in New Zealand of 50 to 100 per cent.

Canada, like the United States, has passed through a period of much greater exportation than to-day, having reached its zenith some 20 years later than the United States. Canada was once, in fact, the principal exporter of cheddar cheese. Other speakers will tell you that exports of cheese from that country in 1903 and 1904 reached 233,000,000 pounds and exports of butter 34,000,000 pounds. The United States in the early eighties was exporting as high as 147,000,000 pounds of cheese and 39,000,000 pounds of butter. Later, in both countries the proportion for home consumption increased along with increasing production, and in Canada there is a heavy per capita consumption of butter, and oleomargarine will not be sold there after next March.

In the Netherlands, Government control and regulation of the entire dairy industry has made it difficult for us to judge statistically of its real condition. Its exports of cheese in 1922, amounting to nearly 144,000,000 pounds, or 110 per cent of its 1909–1913 volume, as you know, gave it first place as an exporter of cheese last year. The method of making comparisons of total exports of dairy products in terms of their whole milk equivalent tends to obscure, in the case of the Netherlands, the important place occupied in its trade by condensed and powdered skim milk, now very large, and principally with Great Britain. The Netherlands, in 1922, exported two-thirds as much butter as in 1909–1913, with rather important changes in destination.

Adjustments to a world economy are fast being recognized as necessary on the part of the dairy industry in the various countries. The dual-factory systems, found especially in the Netherlands and New Zealand, can make either butter or cheese, depending at any time upon the relative strength of the foreign butter and cheese markets. Farsighted exporters, the Danes, the Swiss, and the Dutch, have made contacts with alternative markets, and newer channels of trade have been kept open at considerable effort, for they have discovered that contingencies arise that necessitate important changes in their trade. Certain governments are even assuming control or regulation of the exportation of dairy products in the interest of the whole industry. It may be confidently expected that such steps toward orderly marketing on an international scale will be carried further in the future. That the gathering and disseminating of market news of world-wide scope is essential to efficient business is being recognized by governmental agencies and private firms. The excellent reviews by Mr. Ruddick, the Canadian dairy commissioner, and W. Weddel & Co., of London, are worthy of special mention. In the matter of general current conditions the Swiss Peasants' Union has attempted valuable quarterly reports. Especially the International Institute of Agriculture at Rome is to be congratulated upon its efforts to promote the securing and dissemination of more adequate statistical information on dairying throughout the world.

We have been surveying the world's dairy industry as developments in any one country influence and are in turn influenced by what is virtually one world market. A market such as now exists for dairy products, with sources of supply on every continent, normally makes for stability of supply and of price. In such a market too much emphasis can not be placed upon quality of products and efficiency in production and marketing. Milk as the raw material of dairy products is, of course, essentially as good in one country as in another. Competition in quality resolves itself into a question of methods of manufacturing and marketing. In the degree that economic pressure is brought to bear upon the dairymen of any country in the matter of marketing their produce there must be well-informed adaptation of production to existing demand in the matter of quantity and of quality. But demand is not fixed. In the highly competitive market of the future with a tendency toward standardized high quality with stabilized low price, consumptive demand may be immeasurably increased before the saturation point is reached.

Chairman LARSON. This completes the regular program, but we have several important announcements to make.

The first one is about the program for the afternoon. As you know, we have all been invited to meet the President of the United States at the White House this afternoon. It is necessary that the meeting adjourn promptly at 3.55, so that we will all be over at the White House and in line by 4.15. We will enter at the east side of the White House, and it is requested that you will all wear your badges. This includes the women, who should wear their badges also.

If we are to carry out this afternoon the splendid program that is listed it will be necessary to start promptly at 1.30. The chairman for this afternoon has told me that if the first speaker is here at 1.30—and he surely will be—the program will go ahead whether there is anyone else here or not. [Applause.]

The people of New York City have cooperated in a splendid way in entertaining and helping our delegates to this congress. The chairman of the Milk Conference Board of New York City has been of splendid assistance in getting the foreigners taken care of as they have come into the country through that port. They are wanting to do more, and they are announcing a special excursion throughout New York City that will be of interest to dairymen generally. A splendid program has been arranged for Monday, October 15, and Tuesday, October 16. This committee asks that you register for this excursion at the headquarters, Hotel Onondaga, at Syracuse, as soon as you arrive there; an opportunity also will be given to register at the New York Milk Conference Board booth No. 16 at the Dairy Show.

I am going to call on Dean Mann for just a few words telling you of the plans for entertaining you and welcoming you to the dedication at Ithaca.

Dean MANN. Mr. Chairman, ladies, and gentlemen: The general announcements of the congress have indicated that in connection with one of the excursions the delegates and their friends will be taken on a tour of inspection of certain of the important dairy plants of New York State, visiting the excellent State experiment station at Geneva, and arriving at Ithaca, the seat of Cornell University, late in the afternoon of Friday, October 12.

You will be entertained at dinner by the university, and that will be followed by a reception in the new dairy building, held there in order that you may have opportunity to inspect the building during the evening of your arrival. The formal dedication will then take place on the forenoon of Saturday, October 13, and it will be participated in by certain representaives of our State government, officials of the university, a representative of this congress, and the main dedicatory address will be given by one of our eminent dairy scientists in America, Dean H. L. Russell, of the University of Wisconsin.

Following that, there will be a luncheon, and in the afternoon opportunity will be given to attend a football game between Cornell University and Williams College. You will recall that Williams College has been the seat of the Institute of Politics during recent years.

Fast trains going from Ithaca will make comfortable connections for Washington or New York or Boston or Buffalo and the west, following the formal exercises.

We have extended a general invitation to all persons who are interested. A formal invitation is not necessary. At the same time we have particularly desired to place a formal invitation in the hands of every one of the foreign delegates attending this congress. Due to the inability to obtain addresses in advance and the fact that a number registered prior to the formal opening of the conference yesterday, not all of the foreign delegates have received these invitations. They are available at the information desk in the Hotel Willard. They contain, in addition to the mere invitation itself, a statement of the program and a card asking for certain information which it is quite important that the institution shall have in the completion of its arrangements and also for the convenience of the delegates who may attend.

I would earnestly urge those of the foreign delegates who have not received these invitations to call for them at the desk at the Hotel Willard and then return the cards inclosed promptly.

I may say that our invitation is an exceedingly cordial one to all. We believe that this dairy plant which has been studied with great care with reference to its arrangement and its equipment and facilities, not only for many of the practical forms of dairy instruction but for a wide range of scientific work, will be of interest to you, and we shall be honored and pleased by your attendance. [Applause.]

Chairman Larson. The meeting is now adjourned.

(The meeting adjourned at 12.30 p. m.)

SESSION 3. DEVELOPMENT OF DAIRYING IN THE UNITED STATES.

Honorary chairman, The Honorable **Frederik A. Benzinger**, Agricultural Society of Sweden, Stockholm, Sweden.

Chairman, **Robert W. Scoville**, president, American Guernsey Cattle Club.

Secretary, Dr. **C. W. Larson**, chief, Dairy Division, United States Department of Agriculture.

Memorial Continental Hall,
Washington, D. C., Wednesday, October 3, 1923.—1.30 p. m.

Chairman **Scoville**. The congress will please come to order.

I have the pleasure to present to you the honorary chairman of the day, the Hon. Frederik A. Benzinger, of Sweden. [Applause.]

Honorary Chairman **Benzinger**. Mr. Chairman, ladies, and gentlemen: Yesterday and this morning you will recall, if I may use the term, we were shown an immense picture of a house we might call the dairy industry. We have been impressed by its greatness and now we will look into the different rooms. We will look to see how it is built. We will try to find out whether we can improve different rooms, whether we will embellish them and make them more suitable for anyone to live in.

It is quite natural that we are beginning at the very foundation—that is to say, that we are beginning where all this comes from, and I suppose every one of you knows that that is the cow. Anyhow there is a big difference in cows.

We shall now hear some very important and useful words about how we shall raise the cow, which gives us not only milk but which gives us good milk, which gives us much milk, and which gives us cheap milk as well.

However, before I present to you the Hon. Mr. Lowden, I want to once more thank your Government that they have united all the world to work and to cooperate for the progress of the dairying business. We know very well since the war the combined efforts have not yet begun, and I feel quite sure that the fact your Government has invited us all to come here and to combine our efforts will not only be of great benefit to us but also of some benefit to your great country.

I have now the great pleasure of introducing to you the former governor of Illinois, Hon. Frank O. Lowden, the president of the Holstein-Friesian Association of America. [Applause.]

THE DAIRY CATTLE ASSOCIATIONS AND THEIR WORK.

Frank O. Lowden, LL. D., president, Holstein-Friesian Association of America, Oregon, Ill.

Mr. Chairman and gentlemen of the congress: I am not to speak about the dairy cow and her achievements. I would not be so presumptous as to attempt that before this audience of greater experts than myself, but I am only to speak upon the work of the pure breed associations. That is a much less difficult subject because these associations are composed of men, and it is always easier to discuss men and predict their action than it is to discuss cows and predict their performance. [Laughter and applause.]

I want to say just one word in appreciation of this great congress and to express my deep interest in this meeting. The oftener that men of different countries can come into personal contact over any subject of common interest, the better it is, in my opinion, for the future peace of the world, and if the great industries of the other countries represented here and the great industries of the United States could come into more frequent contact, I am sure it would be for their mutual benefit.

With reference to the pure breed associations upon which I have been asked to say something, I perhaps will be able to say very little that is new to you. Of course I shall be able to say nothing which is new to my fellow-countrymen. Our associations had their origin a little differently from the associations of the older countries. When this country was settled our ancestors had to take whatever cow was convenient. They could pay no especial attention to breeds or breeding, and so until in the last century we had in America just cows.

Now, I have no doubt that you have visited this very sacred spot to us Americans on the Potomac River a few miles below where is entombed the dust of George Washington, the first President of the United States. Perhaps you were not told while you were there that George Washington was probably the most conspicuous and most successful farmer of his time.

The other day in reading some account of his life as a farmer, I came upon this: Only a few months before his death and after he had retired from the Presidency and resumed his life at Mount Vernon, he wrote to his manager as follows:

"And it is hoped and will be expected that more effectual measures will be pursued to make butter another year, for it is almost beyond belief that from 101 cows actually reported on a late enumeration of the cattle, I am obliged to buy butter for the use of my family." [Laughter.]

So you can see that we in America had a problem which your forebears many centuries ago had already solved. However, during the last century we began to give more attention to the breeding of our livestock. There were two courses open before us.

We could, by a process of selection, go on just as your far-away ancestors had done and develop an American cow, if you please. This would have taken, perhaps, 1,000 years, possibly 2,000 years. but our people decided that it would be wiser to adopt the product of the great breeders of your own lands and start with the cattle that had been built up by the process of selection throughout centuries.

And so we went to Great Britain for the Jersey and the Guernsey cows; we went to Scotland for the Ayrshire; we went to Switzerland for the Brown Swiss; we went to Holland for the Holstein. These were the chief breeds with which we began our work.

Now it was necessary, as soon as we had imported those cows, to establish some machinery for the keeping of records, and thus came about (and only during the last half of the last century) the great pure breed dairy associations for all of these breeds I have named.

Their primary work, of course, is to keep the records of breeding—in other words, to look after the pedigrees of these cattle. That in itself is somewhat of a task, but it was not long until our breeders began to speculate upon some further record, namely, a record of performance, and therefore they established what is generally known as advance registry by which the various breeds could have kept a daily performance of such animals as their owners might think were entitled to this distinctive care. That work was usually done in cooperation with the State colleges of agriculture.

That work has proven of great importance to our breeders. It not only shows the accomplishments of the individual cow but it furnishes a very important check upon our ideas of type, for if the advance registry records show that generation after generation of a certain family of cows produces more milk than any other family of cows, without the type of the cow corresponding exactly to the ideal type which we are taught to emulate, we are at once entitled to infer that maybe there is something wrong with our original idea of type and that perhaps we would better correct that.

In other words, in all breeding—I am talking now about our country because I know that as breeders we haven't begun to compare in thoroughness or in patience and, therefore, in accomplishment with the breeders of other lands—in our country we are likely to indulge in fads somewhat as to the type of the individual. Occasionally color becomes the paramount consideration with any kind of livestock to the exclusion of more important qualities.

The advance registry, therefore, honestly conducted over a series of generations of any cow, serves as the most accurate and reliable corrective of any excesses in which we may indulge as to any point in type.

I don't know whether I make that very plain or not.

Another very important work of these associations is education. Notwithstanding the strenuous efforts of the breeders of this country since we first imported purebred cattle, only 3 per cent, we are told by our Government, of all the dairy cattle in the United States are purebred. The remaining 97 per cent are either grades or scrubs.

There is, therefore, a great field awaiting the development which so far has come largely through the activities of the pure breed associations.

These activities are manifested in different ways. We have been interesting ourselves of late years very effectively in the organization of boys' and girls' calf clubs. We go into a community through the inspiration of one of these associations and we get the boys and girls interested in better cattle than any they see about, and bankers usually cooperate with these boys and girls to organize a club and buy a purebred calf or two.

This serves a double purpose. It very frequently happens that the boy or girl who joins the calf club becomes shortly the educator of his father, and you are likely to find upon the farm of that boy or girl's family, where once were scrubs, purebred cows; in other words, this is another case of where "a little child shall lead them."

And then again, they serve this purpose which, in America, is of the utmost importance—they give the boy or girl a new interest in the farm. They show to the boy or girl that farming does not consist in mere deadly and mechanical routine, but that it is a fascinating occupation in itself, and therefore we attach that boy or girl to the farm permanently.

I feel certain that when a generation hence some other great World's Dairy Congress shall meet here—as I hope it will, and I hope we may all be present—you will find that the greatest breeders of all the breeds in America will be those who are now members of the boys' and girls' calf clubs scattered over the length and breadth of our land. [Applause.]

We have been making a concerted warfare against the scrub bull. That is something that you know nothing about in your own countries, at least in the same degree that we do here. It is no easy warfare. The agricultural colleges, in conjunction with the pure breed societies and now with the cooperation of the farm bureaus of our country, are making a united attack upon the scrub bull.

One of the most conspicuous instances of this which has come to my attention lately is in the State of Minnesota. I don't know whether these gentlemen visited Minnesota or not.

A Voice. Some of them have.

Mr. Lowden. They saw your herd then, did they?

A Voice. No.

Mr. Lowden. Well then, they didn't see Minnesota. [Laughter and applause.]

In Minnesota, all of the pure breed associations, not only dairy but beef, have cooperated in a campaign against the scrub bull. They go into a community where the scrub bull has been pretty conspicuous and they say to the farmer, "We don't care what breed you prefer. If you want to produce beef, of course you should have a bull of the beef breeds; but exercise your choice. If you are engaged in dairying or wish to engage in dairying, we have no recommendation to make to you as to what breed you shall use. If you prefer the Jersey, very well; or the Guernsey, good; or the Holstein, very well; but we know that you can't afford to go on using the scrub bull."

That campaign has had very great results. It is still on, as I understand it. In other words, while there is a generous rivalry as between the various breeds, there is as there should be a concerted and wholehearted unity of action as against the scrub bulls of the country.

And so along various lines of this kind the pure breed associations are really making an impression. They have many other duties to discharge which I shall hardly have the time to enumerate but when I tell you that the average milk production in America is less than half per cow of the milk production of the most advanced dairy countries of Europe you will appreciate the enormous field that opens before these pure breed associations.

When I tell you that something over 80,000 cows have advanced through the advance registry and that the annual production of those purebred cows is about three times the average production of all cows in America, you will concede that we have made some progress toward a better dairy cow in America. [Applause.]

I am informed by your chairman that you will have to abbreviate the session this afternon, and I suppose that that contained an implied hint that I should abbreviate my discourse and, therefore, before closing, I want to say to you representatives from other countries that we are perfectly delighted to have you within our midst. We are very glad that you are going to journey with us up to Syracuse to attend our National Dairy Show. We hope really to be pretty well acquainted with you all before you leave, and we hope that when your pilgrimage is ended you will have so enjoyed yourselves that your last word, as you set sail, will be a promise to come again. I thank you.

Chairman Scoville. I am sure we are greatly indebted to Governor Lowden for his message containing, as his messages always do, so much sage advice coupled with shrewd enthusiasm.

Lest some of you might not have been here this morning, the reason for our early adjournment is, as you all probably know, that we must leave here at five minutes to 4 in order to attend the reception at the White House, where the President has kindly consented to receive this congress.

It would be a willful waste of your time to spend any words introducing the next speaker. For a good many years he was chief of the Dairy Division. He was always an unending source of enthusiasm and counsel to us and he grew to be known by the name of the "Big Chief." No matter what the program may say he is now, to those of us who have been in the industry for a long time he always will be our chief. He has left to go into commercial activity, as so many good men have, and the program says something about his being in business in California, but I know you will want to hear from him as our old friend. Mr. B. H. Rawl, former chief of the Dairy Division. [Applause.]

THE RELATIONS BETWEEN THE MANUFACTURER AND THE PRODUCER.

Bernard H. Rawl, assistant general manager, Golden State Milk Products Co., San Francisco, Calif.

The relations between the manufacturer and the producer of milk products determine in considerable measure the status of the dairy industry in a community or in a nation. In these relations are reflected the ability of both to apply certain principles necessary to coordinated effort and hence to a prosperous industry. Any plan involving the manufacturer and producer, therefore, must be economically sound and just. One can not prosper at the expense of the other nor, indeed, without the aid of the other.

That these are the basic principles upon which any successful relationship between manufacturer and producer must rest is so obvious as to make the discussion of the subject of this paper appear almost unnecessary. When we view the situation as it actually stands throughout our country, however, we are compelled to recognize that there are still unsolved problems in this relationship; that there is failure either in the recognition of the fundamental principles involved or else in the methods of applying them. Otherwise there could not be the contention that sometimes exists between the manufacturer and producer; contention that leads to bitter and expensive fights, that results in good for neither, and that costs both the confidence of the consumer.

In the production of milk and the marketing of it in its various forms, there exists a condition found in but few important industries. On account of its perishable character, milk must be consumed or manufactured within a short time after it is produced, and within a comparatively short distance from the farms whence it comes. This makes it desirable for the producer to patronize his nearest factory and for the factory to secure all of the milk in the territory immediately adjacent. In order that these advantages might be enjoyed, the plans by which the manufacturer and producer work must be definite and fair and each must understand his part in those plans. In this way a mutual relationship is brought about that is valuable to both and that is essential to the growth of the dairy industry.

There are, of course, between the manufacturer and producer, certain joint problems around which their closest relations exist. These include such matters as volume of product and its relation to farm and factory efficiency; the extent to which quality affects the value of the product and the part each has in securing it; the proper division of the returns in order that each may receive just reward for his effort; the value of confidence and the relation it bears to organized and coordinated efforts; the type of manufacturing organization as it affects the interests of both; and finally service to others, rendered jointly by the manufacturer and producer, which constitutes the basis of all successful industry.

VOLUME.

The significance of volume to efficient plant operation and to efficient production is seldom fully recognized. Small volume in the factory increases the cost of manufacture and decreases the returns to the producer. Small volume on the farm increases the cost of production, and, of course, is a factor in increasing the cost of manufacture. In either case the factory suffers and in either case the producer suffers.

When a single plant has small volume it may be attributed to bad management; but when every plant in an entire region has small volume, as is sometimes the case, the cause must be attributed to too many plants.

No factory with insufficient volume to operate at full capacity can render the best service. The producer often regards this a factory problem, hence of no concern to him. Indeed, sometimes he encourages small volume in the factory by encouraging the greatest number of factories. He does this on the ground that it will increase competition, and thereby benefit him.

The value of competition is, of course, well recognized. We may even assume that in the end competition will work out maximum efficiency. There is such a thing, however, as too much competition. In such cases the processes of elimination become necessary and they are in the end expensive to all. One inevitable result of such a situation is that the quality of the products suffers, and this is always harmful to both manufacturer and producer.

The remedy for such a situation does not lie in stifling clean competition. Indeed, an immediate remedy is hard to find. The wise course is to prevent such a situation from arising and this can be accomplished if all parties concerned have a clear understanding of their own best interests.

Such a course of prevention means that the manufacturer must realize in advance and must proceed on the basis that the producer is entitled to all that efficient service and fair dealing will justify, not for the good of the producer alone, but for his own as well. It means also that the producer must not be unreasonable in his demands upon the manufacturer and must not expect more of him than efficient service and fair dealing will justify, for indeed more than this is impossible. The producer must realize in advance, also, that too many plants inevitably reduce manufacturing efficiency, from which he too must suffer eventually.

A clear understanding, then, on the part of both manufacturer and producer, of their own best interests, can prevent too many plants and the losses incident thereto.

Coming now to the matter of volume on the farm; no amount of plant efficiency and no reasonable price can make the farm profitable unless it, too, has volume that is commensurate, first, with the investment, and second, with the number of cows in the herd. The first requirement may be met by enlarging the herd, but unless the cows are efficient producers, advantages thus obtained will be fully offset by increased cost of production. Neither small volume then, nor higher volume inefficiently secured, will make a properous and satisfied producer. The effect of this upon the manufacturer is easy to see, for without successful producers the manufacturer will soon find himself without raw material.

The manufacturer therefore is quite as much concerned over volume on the farm as is the producer over volume in the plant. It is essential in both cases, and can be secured only through the coordinated effort of both parties.

QUALITY.

The permanent prosperity of the dairy industry rests very largely upon the qualitiy of its products. The proof of this is found in the fact that our highest grade products come usually from those regions that are foremost as successful dairy districts.

Quality is always a factor in consumption, and consumption always a factor in price. Quality always requires extra expense and can be secured by neither manufacturer nor producer alone. This being the case, the methods by which it can be obtained are of the greatest importance.

Let us consider this matter first from the producer's standpoint. He has a large investment in land, buildings, equipment, and cattle.

This investment is but slightly greater where high-grade products are produced than where low-grade products are produced. The labor costs in the former case, however, are considerably greater. Where no attention is paid to quality and the utmost economy is practiced, the producer omits the sterilization of the utensils and the cooling of the milk or cream; he fails to discriminate against feeding stuffs that impart objectionable flavor to the milk, and to protect it from odors that are absorbed. In such ways the quality of the raw material is injured and its value reduced. To prevent this requires greater expense, of course. In some cases that expense is considerable, yet compared with the total cost of production, even where no attention is paid to quality, the extra expense of securing quality is but a trifle. Even so, the producer cannot be expected to bear that extra expense if first-class raw material brings him no more than the cheapest he can produce.

Here the manufacturer's part begins. He must find a way to pay more for first-grade raw material than he does for second or third grade, or he will receive largely the latter. That way lies in selling high-grade products for more money than is secured for inferior ones. This requires effort and increased expense, and even then is sometimes not easy to do. But it is right, it can be done and it must be done if high-grade products are to be supplied. Quite contrary to the belief sometimes expressed, the producer is by no means averse to supplying first-class raw material if he receives a premium for it. Even a small premium with proper instructions brings surprising results. The producer alone, therefore, must not bear all the blame for inferior raw material.

Great progress in factory operation is being made; nevertheless, it is easy for the factory to turn out goods of inferior quality even though the raw material is first class.

It must be said of the factory, as of the farm, that to do the extra work required to maintain the highest quality involves extra expense. This expense, however, as on the farm, is small compared with the total cost of manufacture. Both producer and manufacturer, efficient as they may be, have greater expenses when they supply products of high quality. On account of this extra effort greater values are obtained which should be shared by both parties.

It occurs sometimes that the producer wants the results of high quality without furnishing high quality raw material; or that the manufacturer desires high quality raw material without paying extra for it. One is just as unreasonable and in the end, just as impossible as the other. High quality in dairy products depends upon the joint effort of manufacturer and producer and upon the recognition that it brings prosperity to both.

DIVISION OF RETURNS.

Since the manufacturer and producer are dependent upon each other in so many ways, the methods whereby they share in the results of their joint efforts are worthy of attention.

There are two such methods in general use. They are as follows: First, the price to the producer is determined by competition, the manufacturer taking his chances on what remains. Second, the manufacturer pays all that sound business will permit, whether above or below competition, realizing that his permanent prosperity rests largely upon the prosperity of the producer.

By the first method competition at times forces the plant to pay more than its returns justify. This is done, however, with the expectation that a more favorable season will follow during which it will be able to recover the losses thus sustained.

Competing plants often manufacture different products. In this way one plant is favored at one season and another at another. The assumption that in the long run supply and demand will hold the different products in proper relation to each other is the theory upon which plants continue to meet competition when their returns do not justify it. Adjustment in the prices between different commodities, however, are sometimes slow, thus increasing the hazard of plant management where this method of paying the producer is used.

The second method, whereby the plant pays all that it can to the producer, and more than competition requires when conditions will permit, must be based upon the assumption that its patrons will not desert it during unfavorable seasons when the plant is unable to meet competition. This plan is possible only where there is no competition or where there is complete confidence between the manufacturer and the producer; confidence in the manufacturer, that he will pay all that the business will justify, also that he will maintain his efficiency; confidence in the producer, that he, having enjoyed the largest possible returns during favorable seasons, will not withdraw his patronage during the unfavorable ones.

Both the manufacturer and producer must share in determining which method is to be followed. They may do it through understanding and confidence in each other, or they may do it through the absence of such understanding and confidence. In either case they both take part in the decision and they both share in the results whether good or bad.

CONFIDENCE.

All business is of course, based upon confidence. Without confidence there is little cooperation; without understanding there is little confidence.

Failures in general business are often caused by insufficient capital. And what attracts capital? First, the skill for doing a useful job; and, second, the understanding of that skill by the owners of capital. Ability and understanding then create confidence. How frequently does failure occur from lack of capital when there is unrestricted confidence behind the enterprise? Not often. Confidence, therefore, is an essential factor in all business. Where two individuals like the manufacturer and producer are intimately concerned with the same product, dependent upon each other at every turn, confidence is the very life of success.

Each must have the ability to do his own part well, the desire to do it well; and each must understand the other. There are forces constantly in action to prevent understanding and confidence between the worthy manufacturer and worthy producer. Such forces result from unsound theories or from narrow selfishness. Happily, the professional confidence destroyer is finding his business growing smaller.

There is hardly an important policy of the manufacturer that is not affected in one way or another by the producer's confidence. When it comes to the matter of securing raw material, the idea that price is the whole thing is entirely erroneous, because it is seldom the case that any ordinary price will not sooner or later be met by a competitor.

But, entirely aside from the matter of supply, it is not feasible for a plant to deal constantly with a large group of producers and give satisfaction without enjoying their confidence in a liberal degree.

Likewise, the producer profits in a similar way. He is the seller, and the seller always benefits if he has the confidence of the buyer. Can the manufacturer always be sure of the grade of the raw material; can he pay more than competition requires during a favorable season and feel sure that the producer will not withdraw his patronage later should the price fall somewhat below competition? The answers to such questions necessarily have a significant bearing upon the price that the producer receives.

Confidence, therefore, is directly involved in the profitableness of the business of both manufacturer and producer. Their success and progress depend primarily upon it. Certainly, then, nothing should be left undone by either that will aid in establishing it. Moreover, it is not difficult to secure when each realizes how his own best interests are served; that he actually makes more money by conducting his business according to the principles that establish confidence than in any other way.

The dairy industry of America needs more understanding and more confidence, not only between the manufacturer and producer, but between all groups.

TYPES OF MANUFACTURING ORGANIZATION.

Much attention on the whole is given to the type of manufacturing organization, and confusion sometimes arises because of too much emphasis upon the type of organization and too little upon the principles that guide its operation.

There are three essentials that an efficient manufacturing organization must possess. They are: capital, skill, and fair policies. Any organization supplying these merits the confidence and the support of the producer.

The three general types of manufacturing organization that exist in the United States are as follows:

First. A company in which the producer owns none of the stock.

Second. A company composed entirely of producers.

Third. A company composed of producers, factory operators, and others who supply additional capital.

It is of course not the intention here to discuss the merits of the different types of organization other than as they have a bearing upon the subject of this paper. As stated above, the usefulness of the organization to the producers does not necessarily depend upon its type. There are those of all types that are highly efficient and successful; that deserve and secure the producers' full confidence and support. There are others of all types that are failures. In every case success or failure depends upon the facilities available for the work to be done and upon the character of the management.

That the producer should participate in the ownership of the plant is most desirable. In this way he has an opportunity to share in its management and its earnings. The plant, in turn, has better opportunities to secure his confidence, and more assurance, therefore, of his support.

That the producer, however, should exclude all others from participation is by no means established. Sometimes more capital is required than the producers can spare from their farms and adequate capital is essential to the success of every plant. But even where outside capital is not needed, the factory management and the factory operators are quite as essential to the success of the plant, as are the producers. Is it not good business, therefore, that all have the privilege of participating in the ownership?

The plant management and the operators after all are the manufacturers, and the same reasons that make it desirable that the producer participate in the ownership apply also to those who operate the plant.

Plants can succeed, of course, without the operators' participating in the ownership, as they can without that of the producers. With the participation of both, however, a greater incentive is created to make the plant efficient and establish better relations between the manufacturer and producer.

Recognizing this, some companies offer, on easy terms to their patrons and to their employees in good standing, the opportunity to share in the ownership of the business. This policy is quite in line with some of the more advanced ideas of industrial relations. It is nothing less than a type of cooperation, through which the producer, the plant operator and the possessor of needed capital participate on an equal footing in the plant ownership, its management and its earnings. Such a plan strengthens the relationship between all groups, and contributes to the development of the industry as a whole.

It is quite erroneous to conclude, however, that full cooperation can not be secured, except through some form of joint ownership, valuable as it may be. Such cooperation can be secured if all understand their problems and their own best interests.

After all, the essential thing is full whole-hearted cooperation, and the method by which it is secured is of secondary importance.

MANUFACTURER'S LEADERSHIP.

The opportunity to conduct a business is afforded by the community and deserves something in return. Such opportunity carries with it an obligation, the fulfillment of which is not only a matter of justice, but also a matter of good business.

In the usual course of business the manufacturer forms intimate relations with the producers. If he is established in their confidence he has an opportunity to exercise considerable influence with them concerning not only their joint problems, but all matters that pertain to dairy development.

The manufacturer's first concern naturally is with such matters as volume and quality, and the establishing of full cooperation in dealing with them. Too often he gets the idea, however, that this is as far as his responsibility goes; that such matters as adequate feed supply and herd improvement are of no immediate concern to him. One single reflection will dispel this idea. The producer must be successful. If he is not, sooner or later the manufacturer fails.

In many cases the producer can increase his net earnings hundreds of per cent by herd improvement, better feeding, and the like. In doing everything in his power to aid in bringing about such improvement, the manufacturer is working not alone for the producer, but for himself as well. Such efforts constitute nothing more than sound, constructive business; that kind of business which is helpful to every individual affected by it; that kind of business that will make any industry grow; that kind of business that deserves and inevitably secures that understanding and confidence so vital to proper relations between all associated business groups.

It is not only his duty, then, as a manufacturer to join actively in every effort for dairy development, it is his opportunity to insure the future of the business he controls and to make it constantly more useful and more successful. But it is even more than this; it is his opportunity also, through aiding in general development, to render a service to the community at large in return for the privilege it has afforded him.

SERVICE.

Business that is sound and permanent is no longer a blood-thirsty humanity-destroying agency. Instead, it is a useful, humanity-serving institution, beneficial to all who are affected by it.

The manufacturer and the producer of milk products are nothing more than partners in a service which, if rendered well, assures them reward.

Upon the producer falls the service of furnishing the world with an abundance of a food that man can not do without; of sharing in the protection of that food, and of preserving the fertility of the soil from which it comes, in order that future generations may not be robbed of the opportunity to be fed and clothed. For this service, well rendered, the methods of commerce must be such as to insure to him returns that are commensurate with the investment he carries, the labor he performs, and the responsibility he assumes.

The manufacturer, in turn, is equally a factor in this usefulness. Upon him falls the service of efficient manufacture and distribution, of carrying the products forward in the best condition to the consumer, and of carrying back to the producer that liberal share of the returns that fair dealing and good business both demand. Upon him also falls the service of doing justice to the capital with which he is entrusted.

The manufacturer, then, serves the consumer, the producer, and the investor. He is a trustee for all; that one may have food, another employment, and still another legitimate returns on his capital. His field is full of opportunity, his position one of trust, and he dare not abuse that trust if he values highly his business. He, too, must receive just returns for his efforts.

The manufacturer and producer, then, work hand in hand in the rendering of a great service. They can not work against each other without lessening their usefulness and doing harm to themselves.

The modern idea that business growth is promoted by assisting others rather than by destroying others was never more forcefully typified than in the true relation between the producer and manufacturer of milk products.

In this relationship there is still room for improvement, for better understanding, more confidence, and more cooperation. Such improvement is gradually taking place and will come more rapidly with a fuller realization that the larger purpose of it all is service, performed in supplying man with an essential of life and health and happiness; and with a fuller realization too, that the rendering of such service constitutes, after all, the soundest form of modern business.

Chairman Scovillee. I have been asked to make an announcement. The committee in charge has noticed, with perhaps a little apprehension, that within the last 48 hours we have been together there has been too much of a tendency on the part of our foreign delegates to flock together. Obviously, if they and we are to obtain the maximum result from this conference we must mingle together.

To our American delegates I want to say it is our fault, not theirs. We must endeavor to break up this combination and to see that we meet them and that they meet us. To our foreign friends may I say, will you please consider every man who has one of these badges on as your guide. That is especially so when you start to move between here and Syracuse. We are at your disposal. Anything we can do to make your visit more instructive as well as more convenient and comfortable it is naturally our duty to do and it will be our pleasure to perform. Please mix up and see if we can't all get together for the next few days. [Applause.]

The next speaker represents a very modern phase of our present-day life. We heard this morning from an expert economist employed by one of the largest banks in America. This afternoon we are going to have the pleasure of listening to an economist employed by what is perhaps the largest manufacturing concern in the United States, turnover considered.

It is very significant that these large institutions find it necessary to study the theory of their business in order that their practice may run true and they employ these experts who are qualified to see that their policy is directed along the right lines. In making the selection, Messrs. Swift & Co. employed a man who had been professor of agricultural economics in the University of Minnesota and professor of business administration at Yale. That was certainly a very happy combination for a concern like Swift, and I have great pleasure in introducing to you Dr. L. D. H. Weld, who is manager of the commercial research department of Swift & Co., of Chicago. [Applause.]

FUNDAMENTAL ASPECTS OF DAIRY MARKETING.

Louis Dwight Harvell Weld, Ph. D., manager, commercial research department, Swift & Co., Chicago, Ill.

Mr. Chairman, ladies, and gentlemen: To speak on the fundamental aspects of dairy marketing I am going to speak as an economist rather than as a representative of Swift & Co.

To treat this subject properly, I think it is best to begin at the beginning and to see how the present marketing system in general has developed. It has two very important characteristics. First, it has developed that marketing is done through a system of middlemen; and, second, that it has been in the hands of individual companies—of private corporations. Individual initiative has been the compelling force in the developing of the present distributing organization.

There has been much loose talk about middlemen in the marketing system. It has been said that there are too many middlemen, that the marketing system is cumbersome and altogether too costly, that goods should be marketed direct from producer to consumer, etc. You don't hear these things said quite so much to-day as you did a few years ago, because we are getting to have a better understanding of the marketing system and why it has developed. It is coming to be realized, in the first place, that marketing is at best an expensive and intricate process, and that it involves the performance of certain services or functions that are absolutely indispensable in getting goods from the producer to the consumer.

I have always found it worth while to list these functions or these services of the marketing organization. They are:

First. The assembling of products from myriads of farms, from country shipping points to large wholesale markets, etc.

Second. The storage of commodities, for goods have to be stored at various steps all the way from the producer to the consumer.

Third. They have to be financed. Money and capital are tied up in the goods as they are on their way from the producer to the consumer.

Fourth. There is the assumption of risks. Whoever takes ownership of farm products on their way to market incurs the risk of a loss from a fall in price.

Fifth. There is the sorting and grading to be done.

Sixth. There is the selling operation, or the sending out of salesmen to make contracts with buyers.

Seventh. There is transportation. The goods have to be hauled from one place to another by railroad or by truck or by wagon.

The point is that all these services have to be performed, whoever performs them, or how few or how many middlemen are involved. It costs money to perform these services. You can cut out a middleman, yes, but you can't cut out these services that have to be performed or the cost of performing them.

It has been perfectly natural that specialization should have developed in the marketing process just as in manufacturing. In fact, middlemen are specialists in performing these marketing services. In manufacturing you have, for example, in the cotton industry, one mill spinning cotton into yarn, another mill weaving yarn into cloth, another mill taking the cloth and dyeing and finishing it.

Just so in the marketing system—one middleman specializes on assembling goods, another on transportation, another on storage, etc. Most middlemen perform two or three or more of these marketing functions, but there is specialization, nevertheless, and there is a subdivision of the marketing process so that there is a succession of middlemen through which goods have to pass in going from producer to consumer.

The reason why this system of private middlemen has developed is simply that it furnishes the most economical and most expeditious method that has ever been discovered for performing these difficult and intricate marketing services.

Now, to come more specifically to dairy products: I shall speak especially about the marketing of butter, but shall also refer to the marketing of milk and cheese. The marketing of these products illustrates some of the most important fundamentals in marketing. Each of these three products presents a different problem. Each is marketed in a different way. Each has its own marketing cost.

Referring to the methods of marketing and the channels of trade through which these product's flow, first, take butter which is marketed in various ways. Perhaps the most typical example would be to trace butter from the small Minnesota creamery through to the consumer in New York City. It is manufactured in the creamery, then passes over the railroad, then into the hands of the wholesale receiver. This wholesale receiver assembles the goods from country points; he has sent out solicitors to make business connections with the country creameries. He finances the shipper by letting him draw draft on the day of shipment. He provides storage for the goods after they arrive in New York. He sorts out the goods by quality. He sells in large lots, usually to a jobber, another middleman. This jobber sends out salesmen and sells to the retailers. He breaks the goods up into very small lots. He delivers one tub at a time to individual retailers just the quality and just the quantity that each wants, and he also extends credit. In smaller cities, there is usually one wholesaler who attends to both wholesale receiving from the country and the distribution direct to the retailer. It is only in the largest cities that we generally have the separate steps described above.

Butter may be marketed through the centralizer who often has his own jobbing houses, his own distributing organization, especially in larger cities, for selling direct to retailers; or he may sell through independent wholesalers. Or, butter may be marketed through the meat packer who distributes direct to retailers through his own nation-wide distributing organization. I will tell you more in detail about that at one of the Syracuse meetings.

Milk is marketed in an entirely different way. There is usually only one middleman—that is, besides the railroad. Sometimes it is sold to retailers by the wholesale milk distributor, but more commonly direct to the consumer at his own back door.

Cheese, again, is marketed through different channels. It differs from butter in that there is usually a wholesale dealer in the cheese-producing regions who assembles cheese from the many small factories. For distribution in distant cities he sells sometimes to a wholesale grocer, sometimes to a specialized wholesaler, sometimes to a meat packer.

So you see that the methods of marketing these three products are entirely different.

Now we come to the cost of marketing. The two most interesting things are: First, the very narrow margin of cost on which butter is marketed; and, second, the great difference in the marketing costs of these three commodities. It is convenient to measure the marketing cost by showing the percentage of the final retail price that the farmer receives.

I have had prepared a chart showing the cost of marketing butter from the Minnesota creamery to the New York consumer.

Cost of marketing butter from Minnesota creamery to New York consumer, 1922.

	Cents.	Per cent of retail price.
Retailer's margin	6	12.5
Jobber's margin	1¾	3.6
Wholesale receiver's margin	¾	1.6
Freight	1½	3.1
Creamery	3½	7.3
Received by farmer	34½	[1] 71.9
Paid by consumer	48	100

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[1] Five-sixths pound of butter fat.

These figures are really based on rough averages for 1922 and they are approximate figures. This shows the price paid by the consumer for butter in New York as 48 cents. The farmer received 34½ cents for enough butterfat to make a pound of butter—approximately five-sixths of a pound of butterfat. The creamery margin is 3½ cents per pound; freight 1½ cents per pound; wholesale receiver's margin, three-quarters of a cent; the jobber's margin 1¾ cents. That varies. Often it is 2 cents or more, especially if butter is cut into pound prints. The retailer's margin approximates 6 cents.

It is a significant thing that the percentage received by the farmer is almost 72 per cent.

I might say that butter is marketed on about as small a margin between producer and consumer as any product that there is—any farm product or manufactured product. I don't know of another product, either agricultural or manufactured, where the producer gets as much as 70 per cent of the final retail price. For farm products in general, the farmer gets only about 50 per cent. For many farm products he gets only 30 or 40 per cent. But for butter he gets approximately 70 per cent.

The reasons why butter is marketed on such small margins are: First, that it is a product of high intrinsic value and small bulk. This means it is easy to handle and that the freight rate is an insignificant part in the marketing cost. Second, it moves in large volume throughout the year, even though there is a pronounced seasonal variation. Third, it is easily graded. The scoring system of grading butter is unique. There are very few products that have such a fine method of measuring and of indicating quality. Fourth, there are accurate market quotations that can be used as a basis of trading. A great deal of trading in wholesale markets is done on the basis of published quotations, which means that the ordinary dickering and bickering on price for every transaction is not necessary. The New York quotations, which are most generally used, are made by a private concern that has been in business for a great many years, and in whom everybody has confidence. Fifth, the turnover of butter in dealers' hands, especially in retailers' hands, is very rapid. A dealer does not have to carry a dozen different kinds of butter as he does of a great many other products that he handles. Generally one or two grades will suffice, and he can stock up every day or two, and move it out very rapidly.

On the chart the retail margin is only about 12 per cent of the final retail price. It costs a retail store about 18 to 20 per cent of its sales to do business. So you see that butter is sold by the retailer on a gross margin that is very much smaller than the average cost of doing business for the whole store. That does not mean that he necessarily loses money on butter, because butter is turning over in his hands much more rapidly than are his other products, and consequently the selling cost is lower.

The sixth reason is that there is practically no waste in marketing butter as there is in marketing many other perishable products, such as fruits and vegetables.

To compare this marketing cost for butter with the cost of marketing cheese and milk, the producer gets about 70 per cent of the final retail price in the case of butter, about 50 per cent in the case of cheese, and only about 40 per cent in the case of milk. There is a very marked variation.

The reasons why milk is so expensive to market as compared with butter are:

First. It is probably the most highly perishable product that is marketed at all. It requires constant care; it has to be moved very rapidly, which means special railroad service.

Second. Milk is hard to handle, since it is a liquid; it has to be put in cans or in glass bottles. There is much breakage and loss of bottles, and there is expense in keeping bottles clean, etc.

Third. It is expensive to deliver. It has to be delivered from house to house at early hours in the morning of every day.

Fourth. It is different from all other products in that an entirely separate and special marketing organization has had to be developed to handle it all the way through. The existing marketing organizations can't be used in marketing milk.

Now, note that for butter the farmer gets approximately 70 per cent and that it passes through the hands of three or four different middlemen. In the case of milk, the farmer gets only about 40 per cent and yet it passes through the hands of only one middleman. This illustrates an important marketing principle, viz. that the cost of marketing does not depend upon the number of middlemen through which a product passes; it rather depends upon the characteristics of the commodity itself.

The mere statement of these facts blasts the common notion that middlemen are responsible for multiplying market costs, for butter passes through the hands of three or four middlemen, and yet is marketed on a smaller margin than any commodity that I know of.

On the whole, the marketing machinery for dairy products is highly efficient. It has developed under private initiative and in the hands of private companies. Wholesalers are in keen competition with each other. Net profits are kept at a minimum. If I could have shown the net profit of the different dealers on that chart it would have been a very, very, insignificant part of the final retail price.

I have laid emphasis, as I was asked to when I was requested to write this paper, on the middleman system as it has developed in private hands. I don't want you to think that by laying the emphasis, as I have, on the efficiency of the present system, I am at all against cooperation. I have always favored cooperation—cooperative marketing. No one admires the accomplishments of the cooperative creameries more than I do. When I was on the faculty at the University of Minnesota I studied them at first hand.

But what I have said does mean this:

First. That the present system of wholesale distribution is highly efficient and hard to improve on.

Second. That by extending cooperation to terminal markets this will not eliminate the marketing services—the marketing functions that have to be performed. An organization will have to be built up to perform them and expense will have to be incurred in performing them.

Third. There is no chance for success unless the management of the cooperative organization is in the hands of highly efficient (and that means high-salaried) men who can cope with successful and experienced private companies, which will offer severe competition, just as severe as they are offering each other.

Finally, let me congratulate the dairy farmer on the situation that he finds himself in to-day. There is a great deal said about how badly off the farmer is; that the prices of farm products are lower than the prices of manufactured products, so that the farmer gets relatively less for what he sells than the prices he has to pay for manufactured goods. That is true of farm products in general, but, fortunately for you people, it is not true at the present of dairy products. The wholesale price of dairy products is on a parity with the prices of manufactured products and this means that the dairy farmer is better off, relatively, than other farmers. Of this I am sure we are all glad, and I congratulate you that it is so.

Chairman Scoville. The author of the next paper is unavoidably absent and, under the rules of the congress, his paper will be placed at the end of the program, to be read if opportunity permits.

We have exactly 51 minutes left and, allowing 1 minute for the necessary transition from one speaker to the other, it is quite obvious that the two remaining speakers have 25 minutes apiece if the time is divided equitably.

I will waste none of their time in introducing them except to say that Mr. Miller was drafted into the dairy industry. If my memory serves me right he was called upon to aid the New York State Dairymen's Association in one of their hours of need and he became so much interested in the proposition that he devoted all of his time to their work and has since been elected president of the National Milk Producers' Federation.

I take great pleasure in introducing to you Mr. J. D. Miller, of New York. [Applause.]

COOPERATIVE MARKETING OF MILK.

John D. Miller, president, National Milk Producers' Federation; vice president and general counsel, Dairymen's League Cooperative Association, New York City.

Mr. Chairman, ladies, and gentlemen: May I in the beginning, as the humble representative for the time being of the men and women who milk the cows, extend to the foreign delegates here assembled a welcome to this great World's Dairy Congress, and may I express the hope that has been expressed by other speakers, that this may be but the beginning of such meetings to be held in different places of the world by which those engaged in the great dairy interests may come together for mutual consultation and information.

It is a disappointment to your present speaker that he who was on the program to speak at this time is unavoidably absent, a man who has been a master builder of cooperative associations and one who has written a cooperative marketing law that has been adopted by many of the States of the Union. I refer to Mr. Sapiro. His address no doubt would have laid the foundation, or at least have been the background, for something that I might say, but which by the limitations of time it will not be expedient for me to discuss.

I take it that all will agree that it is not a healthful thing in industrial or commercial circles to have any body of men, be it buyer or be it seller, with power to arbitrarily fix prices on commodities moving in commerce, that there should be at all times an equality of bargaining power, and that no body of men, however upright and able, should be intrusted with the power to arbitrarily determine the prices of commodities.

One of the greatest industrial movements in this country during the last four decades has been the centralization of the control of industries and of commerce. In the old days, a farmer could go to the village shoemaker or the village blacksmith or the village tailor and exchange his butter, cheese, milk, or vegetables for their articles, but by this process of centralization these articles are now made in great plants covering hundreds of acres; and while owned by many different people widely separated, the control is centralized in the hands of a few men who have established sales agencies for their wares throughout the civilized world.

While these great organizations, all, or nearly all, corporate in form, have sometimes abused their power, as a whole, they stand for efficiency and economy and have become such a part of the industrial and commercial life of the Nation that their elimination would stagger industry and commerce. While this process of consolidation has been going on in other industries, farmers (in that they must continue to produce singly) have lagged behind in the method of marketing and have not followed the example of the great commercial and industrial captains who both produce and sell collectively. The economics of agriculture dictate that farmers must produce singly. By cooperation, they are now attempting to market collectively.

If I were to state in a sentence the object and purpose of the cooperative marketing associations of the United States, it would be that farmers are thus seeking to retain the control of their products until they can be sold in markets where prices are determined by nation-wide and even world-wide conditions, instead of conditions at points of production where there is always a surplus.

In stating this to some of you gentlemen who represent countries that are much further advanced than are we in the method of cooperating marketing, I will say that since the beginning of cooperative marketing in the United States we hāve learned much and we can learn still more from what you have done in blazing the trail as to cooperative marketing by farmers.

The beginning of the work in this country was by the establishment of local butter and cheese factories. There are now many of these. Some of these market their products singly, the one creamery selling its own products.

In several regions, however, there is a distinct movement on the part of these locally owned plants to create State or regional associations to act as the common selling agent for all. The economies that can be thus perfected are obvious, and by so doing these associations, operating in a larger way, can establish trade labels that, becoming known to the consuming public, insure a continuity of demand for their products.

Probably the most rapid development of cooperative marketing of milk within the past few years has been in regions tributary to great cities. Some of these organizations have passed through several stages of development. In the beginning, nearly all of them were mere bargaining associations. They negotiated with buyers as to prices; and with these prices agreed upon, farmers delivered milk directly to the plant of the buyer, receiving their pay directly from the buyer.

Some of these organizations are still functioning in this way and are performing services of real value not only to their members but to distributors and the consuming public, in that they tend to stabilize conditions in the territories where they operate.

Others have found that conditions in their territories are such that real merchandising methods are necessary; that it is necessary for them to collect and distribute the proceeds of all sales—this largely caused by the ever vexatious question of surplus milk. The seasonal surplus is frequently large, and with one price named to buyers such price must of necessity be low enough so that the surplus may be manufactured without loss or else distributors competing with others in selling in city markets must reduce purchases, the farmer thus finding that his only choice was to accept a low price for all his milk or to sell part of it at a fair price with no market for the remainder. Distributors buying the farmer's milk, therefore, were sometimes compelled by relentless competitive laws to buy all milk upon a surplus price basis or to refuse to take a part of the milk during the surplus period, there being an ever present pressure to turn back to the farmer milk that buyers could not use in their usual business.

Cooperative associations collecting the proceeds of sales can correct these conditions by naming one price to buyers for all milk that they sell in the city and another price for the manufactured surplus. They can also name prices to those whose principal business is manufacturing that will permit such manufacturers to meet the competition of others manufacturing in localities where production costs are lower, while farmers delivering milk that is sold at the lower price are not discriminated against in that the proceeds of all sales are blended into one general fund, with uniform distribution per unit, subject always to locality and quality differentials, so that it is immaterial to a farmer whether his milk is a part of the manufactured surplus or goes into the higher price markets.

In the beginning in these regions tributary to cities, there was considerable opposition on the part of the public, as well as opposition on the part of the long-established distributors. This opposition, in a large measure, was based upon a misunderstanding of the purposes and objects of the cooperative marketing association, and when the general public came to know these objects and purposes, when it became known that they were not arbitrary price-fixing associations disregarding economic laws, when it became known that the great object and purpose was to retain control of milk until it could be sold in markets where prices were determined by economic laws, the public hostility disappeared and the public attitude is now distinctly sympathetic and helpful. For the same reason many of the long-established distributors have come to realize that this plan of operation, popularly known as the pooling plan and which will be explained further at the meeting in Syracuse, offers to them the one constructive solution of a problem theretofore most vexatious, a problem the failure to find a solution of which has, in different localities, at times led to destructive milk wars.

Many of these old distributing agencies are, therefore, sincerely cooperating with these marketing associations and are so coordinating their work that the farmer may have an equal voice in the determination of prices, that the milk shall be taken from the farm to the city as economically as possible, and that the price that the city consumers pay shall be as low as the cost of production and distribution will permit, with a fair distribution of the proceeds to the distributor and producer.

The fear that in the beginning was expressed by some that to pool the proceeds of sales would mean a deterioration of the quality of the milk has been proven to be unfounded in that these associations in making distribution to farmers pay premiums for milk of superior quality.

Just a word—as I must hasten—as to how these cooperative associations are financed. Some are capital stock corporations and are financed by the sale of stock to members. Others are nonstock corporations and are financed by loans from members; while still others are financed by both sales of stock and loans. Generally, when financed by loans they are paid off periodically from the proceeds of other loans made from members, thus creating a revolving capital fund.

The form of the organizations and their methods of financing are, however, so varied that no general statement applies to all. Let it be stated that the efficiency of many of these organizations and the magnitude of their operation are such that they seem to have become a permanent part of the industrial and commercial life of the Nation and that with efficient management their future is assured.

This discussion would be hardly complete, however, without a reference to some of the more intangible benefits that accrue to farmers by membership in this organization, for any student of the deep things of life knows that there are things that can not be measured by dollars and cents.

Before the formation of these organizations, farmers knew that they had no voice in determining prices that they were to receive. Prices for months in advance were announced by buyers, thus causing the formation and growth of a spirit of intense hostility. As farmers under this method, we found ourselves losing our self-respect, now restored to us by collective action.

As members of these associations, we have brought home to us lessons of thrift in that we realize as never before the cumulative power of small savings as at the end of each fiscal year we receive from the association a bond for the small sums deducted from our milk checks for capital purposes.

Membership in these associations tends to enlarge and widen our vision and understanding in that we find reflected in our monthly milk check the results of economic chaos in any part of the world, thus bringing home to us, not in an academic but in a practical sense, the necessity of stability and order. We learn as never before that the people of no country can obtain the highest degree of prosperity while the peoples of other countries are prostrate, and that the peoples of the world are bound together by laws which they did not make and which they can not repeal.

Finally, membership in these organizations tends to lift members to higher and still higher levels of intellectual and ethical development in that being formed for self-help and mutual help, they are based upon ideals which appeal to the best instincts of men.

Chairman Scoville. For more years than most of us can remember, the next speaker has been laboring for the advancement of agriculture. For 35 years he has been associated with the Department of Agriculture, devoting most of that time to educational matters. Doctor True has a message for us that I am sure we will all be glad to hear. Dr. A. C. True, of the Department of Agriculture. [Applause.]

RESEARCH AND EDUCATION IN AGRICULTURE, INCLUDING DAIRYING, IN THE UNITED STATES.

Alfred Charles True, Ph. D., D. Sc., specialist in States Relations Work, United States Department of Agriculture.

When this congress was planned it was expected that various phases of dairy education and research would be presented at meetings of the congress, and it was thought that it might be helpful, especially to members from foreign countries, if a brief presentation were made in outline of our general system of agricultural education and research and its application to dairying.

In the United States, research and education relating to dairying and dairy husbandry are carried on in connection with the institutions which deal broadly with agricultural research and education. These include the United States Department of Agriculture, the

State agricultural colleges and experiment stations, and secondary schools maintained by States, counties, or local communities. There is also some research work on matters relating to dairying conducted by State departments of agriculture and other public agencies in States and municipalities.

AGENCIES FOR RESEARCH IN AGRICULTURE.

The principal agencies for research in agriculture are the United States Department of Agriculture and the State agricultural experiment stations.

Department of Agriculture.—The Department of Agriculture, under the act of Congress of 1862 establishing it, has authority "to acquire and to diffuse among the people of the United States useful information on subjects connected with agriculture in the most general and comprehensive sense of that word." Subsequent laws have enlarged its functions by establishing within it regulatory and service agencies, some of which have duties outside the agricultural field. In 1889 the department was raised to the front rank, having at its head a member of the President's Cabinet. Since that time its growth has been great and rapid. At present its general officers are the Secretary of Agriculture, Assistant Secretary, Director of Scientific Work, Director of Regulatory Work, and Director of Extension Work. Its employees number 20,000, of whom 4,800 are in Washington. About 2,000 scientists are engaged in its research work. In 1921–22 the appropriations for its regular work and publications aggregated $40,000,000, of which $10,000 000 is used for research.

Its research work is done through the following bureaus: Weather Bureau, Bureau of Animal Industry, Bureau of Plant Industry, Forest Service, Bureau of Soils, Bureau of Chemistry, Bureau of Entomology, Bureau of Biological Survey, Bureau of Public Roads (and Agricultural Engineering), Bureau of Agricultural Economics, Office of Experiment Stations, Division of Insular Stations, and Bureau of Home Economics. Besides a large number of scientific and technical reports and bulletins and popular publications, especially the series of farmers' bulletins, the department publishes the following periodicals: Journal of Agricultural Research, Experiment Station Record, and Weather Review.

The research work is carried on in laboratories and experimental fields in Washington and vicinity and at field stations in the States, Alaska, and the insular possessions. There are also many special investigations in the United States and other countries and much research work in cooperation with the State agricultural colleges and experiment stations.

Office of Experiment Stations.—The Office of Experiment Stations administers the Federal acts (Hatch and Adams Acts) granting funds to the State agricultural experiment stations, makes an annual inspection of their work and expenditures under the Federal acts, has advisory relations with them regarding lines of work, equipment and personnel, prepares reports to Congress on their work and expenditures, and collects and disseminates information regarding similar institutions throughout the world.

The Experiment Station Record, prepared in this office, contains summaries of the publications of the Department of Agriculture and the agricultural experiment stations and similar institutions in the United States and elsewhere, and of other scientific literature pertaining to agriculture wherever published, together with editorials and notes on developments in agricultural research and the progress of institutions for agricultural education and research throughout the world. The Record is published in two annual volumes of nine numbers each, with detailed author and subject index. The forty-seventh volume is now in progress.

Agricultural Experiment Stations.—Agricultural experiment stations have been established under Federal and State laws in 48 States. There are 50 of these stations, 47 of which are departments of agricultural colleges. In Ohio the station is a separate institution. In New York, Connecticut, and New Jersey there are separate stations, in addition to those connected with the colleges. In a number of the larger States substations are maintained under State laws. These are mainly engaged in the more practical experiments with crops and livestock to meet special local conditions.

In 1921 the total income of the stations was about $7,500,000, of which $1,440,000 were Federal funds granted under the Hatch and Adams Acts ($30,000 to each State), about $3,700,000 were State funds, $1,000,000 were proceeds of sales of farm products, and about $1,360,000 came from miscellaneous sources.

The general management of the stations is given by the State legislature to boards of trustees, which generally are also the boards managing the agricultural colleges. Usually the members of these boards are appointed by the governors of the States, but in some States they are elected by the people. The trustees determine the general policy of the stations, pass in a general way on their equipment, work, and expenditures, and appoint their principal officers.

Governors, State superintendents of education, or commissioners of agriculture are in some States ex officio members of the station board.

The direct management of the station is committed to a director, who reports to the president or dean of the college.

The staff consists of scientists and technically trained persons representing different branches of agricultural science and practice. There are also farm superintendents, clerks, laborers, and other helpers.

About 1,900 persons are employed in the work of the stations, of whom more than 1,500 are scientists and technically trained persons. About 500 of these give part of their time to teaching or extension work.

The stations are partly housed in buildings used also by the teaching and extension departments of the colleges, and also use portions of the college farms, which often comprise hundreds of acres. But they also have many special buildings, experimental fields, farm machinery, animals, and elaborate equipment devoted entirely to research.

In the Hatch Act, which grants $15,000 to each State, the work of the stations is defined as follows:

> It shall be the object and duty of said experiment stations to conduct original researches or verify experiments on the physiology of plants and animals; the diseases to which they are severally subject, with the remedies for the same; the chemical composition of useful plants at their different stages of growth;

the comparative advantages of rotative cropping as pursued under the varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural and artificial, with experiments designed to test the comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective States and Territories.

Under the Adams Act, which grants $15,000 to each State, the work must be confined to original research. The funds provided under this act are therefore used for the more fundamental scientific work of the stations. For a considerable period the work of the stations was chiefly on problems relating to plant and animal production. In recent years increasing attention has been given to studies connected with cost of production, marketing, standardization of products, and other economic problems.

In addition to their experimental work, many of the stations have carried on analytical and other work connected with State control of fertilizers, food, feeding stuffs, seeds, diseases of plants and animals, etc. The present tendency is to lodge such work more fully in the State departments of agriculture.

The headquarters of the stations are as a rule at the State agricultural colleges, where the more important work in laboratories, greenhouses, barns, and fields is carried on. There are, however, many special investigations and experiments in different localities, including a considerable number of experiments in cooperation with farmers.

The results of the station work are disseminated through annual reports and popular and scientific bulletins, which are transmitted in the mails free. In 1921 the stations issued 400 publications and their mailing lists aggregated 1,000,000 addresses. Summaries of these publications and other information regarding the stations are also widely circulated through the agricultural and other journals. Station officers, State and county extension agents, and cooperating farmers give information and demonstrations to large numbers of farming people at meetings, through correspondence. telephone messages, visits to farms, and in other ways.

AGENCIES FOR RESEARCH IN DAIRYING AND DAIRY HUSBANDRY.

In the Bureau of Animal Industry of the Department of Agriculture is a Dairy Division, which investigates problems concerning the breeding, feeding, and management of dairy cattle and the care and handling of milk and manufacture of its different products. Herds of dairy cattle are maintained as an aid to production studies, and research laboratories and a factory are available for the study of manufacturing processes. When new methods or new products have been perfected these are introduced into the various States through appropriate State agencies. The division is also charged with details of administration of the laws concerning the inspection of factories making renovated or processed butter.

Work relating to dairy animals or products is also carried on by this bureau through divisions of field inspection (including matters relating to the transportation, importation, and quarantine of animals), tuberculosis eradication, cattle-tick eradication in the Southern States, and animal pathology.

Other bureaus dealing with matters relating to dairying or dairy husbandry are the Bureau of Plant Industry (through its division of cereal and forage-crop investigations, dry-land and irrigation agriculture, foreign seed and plant introduction), Bureau of Chemistry (in its food control laboratory), and Bureau of Agricultural Economics (through its divisions of farm management and cost of production, dairy and poultry products, statistical and historical research, agricultural cooperation, and crop estimates), and Bureau of Home Economics (through its studies of utilization of dairy products in human diets).

The Office of Experiment Stations maintains a department of dairying and dairy farming in Experiment Station Record, and other departments of this journal contain many abstracts of articles relating to dairying and dairy husbandry.

The agricultural experiment stations in the several States generally have one or more scientific workers devoting themselves to investigations relating to dairying or dairy husbandry. The number of such workers in 1922 was 105. In a classified list of projects carried on by the stations in 1921, compiled by the Office of Experiment Stations, out of 4,718 projects 151 dealt with dairy cattle and 118 with dairy products. These included breeding, feeding of calves and heifers, comparison of many feeding stuffs in rations for dairy cows, protein supplements, herd management, cost of milk production, studies on milk secretion and production, experiments with milking machines, chemistry and bacteriology of dairy products, butter making, cheese making, ice cream studies, milk composition, handling and marketing, etc.

HIGHER EDUCATION IN AGRICULTURE.

The institutions for higher education in agriculture are of two types: (1) Colleges of agriculture in universities, and (2) separate colleges in which instruction in agriculture is combined with instruction in mechanic arts, home economics, and a variety of other subjects. The courses in agriculture in these two types of institutions do not vary materially. Their number and range depend chiefly on the income, equipment, and size of the agricultural faculty. College courses in agriculture are given chiefly in the public land-grant colleges and universities, but a number of private institutions also offer such courses.

The colleges are under control of boards of trustees. The chief executive officer is a president, under whom is very often a dean in immediate charge of the agricultural work. The number of professors and assistant teachers of agriculture varies greatly, but the larger and more wealthy institutions now have agricultural faculties of 50 or more teachers. In 1922 the agricultural faculties aggregated over 2,500 persons and there were about 28,000 students. These institutions are in general equipped with a number of substantial buildings and large farms used for agricultural instruction, herds of different kinds of animals, special scientific apparatus, farm machinery, agricultural libraries, etc., in addition to the equipment used for instruction in natural sciences, languages, mathematics, and other subjects usually included in college courses.

There are at present 48 State institutions in which college instruction is given to white students and 17 colleges for colored students in the Southern States. Similar institutions are maintained in Porto Rico, Hawaii, and the Philippines.

The data available at this time indicate that about $10,000,000 was used for agricultural instruction in these colleges in 1921. They annually receive $2,500,000 from the Federal Treasury but only part of this money is used for the teaching of agricultural subjects.

Under the head of agriculture, instruction is given in plant production (including agronomy, horticulture, and forestry), animal production, agricultural technology (e. g., dairying, sugar making), rural engineering, rural economics, and sociology. There is also instruction regarding plant and animal diseases, injurious and beneficial insects, and predatory animals. In the agricultural courses special emphasis is laid on those subjects most important to the agriculture of the region in which the college is located. Thus dairy farming is emphasized in the Northeastern States, cotton farming in some Southern States, the growing of wheat, maize, and other cereals in the North-Central States, dry farming and irrigation in the Western States, fruit growing in the Pacific Coast States and Florida.

Combined with the instruction in agriculture, courses are given in natural sciences, mathematics, languages, history, political and social science, etc., in order that the graduate in agriculture may have a liberal as well as a practical education.

The amount of time devoted to agricultural subjects during the regular four-year course varies in different colleges, but averages about 40 per cent. In some colleges emphasis is laid on the fundamental sciences during the first two years, but the present tendency is to give a considerable amount of agricultural work in those years. There is much elective work during the third and fourth years, in which the student is expected to give special attention to some subject of particular interest to him and to combine with this a group of studies to make a well-rounded course. This group system of electives is now much more favored than a system of free electives, which often results in too narrow specialization or too superficial work on too many subjects.

The regular college courses in agriculture are based on four years of study in a secondary (high) school and seven or eight years in an elementary school. The entrance requirements on this basis include instruction in English, mathematics, history, and elementary science, usually combined with Latin, or a modern language, or agriculture. The giving of entrance credit for agriculture is a comparatively new thing and thus far only a few students have satisfied the requirements in this subject.

In recent years the agricultural colleges have undertaken the professional training of teachers of agriculture and for this purpose have established departments of agricultural education. Courses in educational psychology and the principles and methods of teaching, with special reference to the teaching of agriculture, are given, usually in the third and fourth years of the college course. Teachers in service are also given opportunities for professional advancement by means of short courses, particularly in connection with the summer term of school.

Since the passage of the Smith-Hughes Vocational Education Act in 1917 the agricultural colleges have been designated to carry out the provisions of that act relating to the training of teachers of agriculture. This has greatly strengthened their departments of agricultural education.

The four-year courses in agriculture ordinarily lead to the degree of bachelor of science (in agriculture). Graduate courses are now given in a number of the colleges leading to the degree of master of science or doctor of philosophy. Persons preparing to become investigators, teachers, or agricultural experts are recommended to take graduate courses.

Many of the colleges offer short courses of a more practical kind for students engaged in farming or elementary teaching. These vary in length from a week to two years and are usually held in the winter or summer.

HIGHER EDUCATION IN DAIRYING AND DAIRY HUSBANDRY.

Dairying and dairy husbandry are taught in most of the agricultural colleges. In 1922 there were more than 150 dairy teachers in these institutions. Either both subjects are taught in a department of dairying or dairy husbandry, or dairy husbandry is taught in the animal husbandry department, and only subjects pertinent to the handling and manufacture of milk and its products are treated in a department of dairy industry or dairying. Such subjects as dairy chemistry, dairy bacteriology, or biology may be given in the other departments.

The amount of instruction in dairying and the available equipment in different institutions varies widely, depending on the financial condition of the institution, the demand for dairy teaching within the State and the general thoroughness of the instruction offered at each particular college. In general, however, each institution usually has available for teaching purposes a dairy herd containing representatives of several dairy breeds. Some institutions have exceptionally good herds of over 100 animals, containing many individuals with highly advanced registry records. The college herds are not only used for instruction in judging, but in many institutions they afford a source of practical experience for students in milking, feeding, and caring for dairy cattle. This practical experience is supplementary to the more theoretical courses in dairy husbandry. Besides this, students are usually required or recommended to take general courses in animal feeding and animal breeding.

The principles and practice of handling and manufacturing milk and its products are given in variable numbers of courses. The courses emphasized are usually on subjects which receive the most practical attention in the State. For instance, at the Massachusetts Agricultural College special courses in market milk and butter making are given, but the manufacture of the other milk products is taken up in one combined course. New York and California have one or more special courses for each product and Wisconsin has several courses in cheese making, but the other milk products are given in combined courses.

The dairy departments usually have laboratories as nearly on a commercial basis as possible, where at least the milk from the college herd is taken care of by pasteurizing and selling it; separating it and making butter; or making it into cheese, ice cream, powdered, evaporated, or condensed milk, or other milk products. This furnishes an excellent opportunity for students to obtain practical experience under near commercial conditions. In addition to the instruction and practical training given at the institutions, the students obtain further information by supervised visits to neighboring dairy herds, commercial milk stations, condenseries, creameries, cheese factories, ice-cream plants, etc. Practice in city milk inspection is often obtained by inspecting the milk delivered in the college town.

Judging teams from some institutions also represent them at dairy cattle and dairy product shows, and in some cases entire classes are required to attend the shows.

Many of the agricultural colleges give graduate work in dairying or dairy husbandry toward M. S. or Ph. D. degrees. This graduate work is often directly under the supervision of a school or department dealing with all the graduate work of the institution. Special courses and seminars designed for graduate students are given in the dairy departments in most cases. Graduate students are usually required to complete a definite piece of research work and prepare a thesis on this subject.

Most of the colleges also give short courses in dairy husbandry or dairying. The University of Wisconsin, for example, has special winter dairy courses of 12 weeks for dairymen with experience, a summer dairy course of 10 weeks for inexperienced persons, and a short course in agriculture including dairying of two winter terms of 15 weeks each, besides special courses for teachers in the summer session and a two years' course in which students with practical experience elect subjects given in the four-year course. The University of Minnesota gives specialized short courses of one or two weeks' duration for ice-cream operators, creamery operators, milk-plant operators, and cheese-plant operators.

During the past year large amounts of money have been appropriated or expended for the construction of new dairy buildings and dairy barns at the State agricultural colleges. A new dairy building costing nearly $600,000, with equipment, is being completed at Cornell University in New York. Dairy buildings costing over $225,000 are being constructed at Davis, Calif., connected with the University of California, and at the Minnesota Agricultural College, while $150,000 has been appropriated for a new dairy and animal husbandry building at the New Jersey Agricultural College, and $100,000 for a dairy building at the Maryland Agricultural College. Additions to the present dairy buildings or new dairy barns have been made at the State agricultural colleges of Kansas, Missouri, West Virginia, Virginia, Indiana, Nebraska, Louisiana, and Oklahoma.

EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS.

From their beginning the agricultural colleges and the United States Department of Agriculture have sent out members of their staffs to make addresses at farmers' meetings. They have also distributed publications. The popular publications of the department, particularly the Yearbook and the farmers' bulletins, and the bulletins of the experiment stations, have been freely distributed in very large numbers. An enormous correspondence on agricultural subjects has also been conducted by the agricultural institutions.

About 50 years ago the agricultural colleges and State boards or departments of agriculture began to hold annual series of meetings in different parts of the State, at which addresses were delivered by experts and successful farmers, followed by questions and discussion from the audience. These meetings, lasting from one to three days, have been called farmers' institutes. They proved so popular that State legislatures made special appropriations for their maintenance. Regular staffs of lecturers were employed and special publications were issued. The number of meetings grew to several thousand annually. The total attendance mounted until it aggregated several million. Special institutes for women and young people were added. Music and other recreational features were introduced, and in recent years lantern slides and moving pictures have been used increasingly.

About 20 years ago, when farmers in the Southern States became alarmed at the spread of the cotton boll weevil, the Department of Agriculture, under the leadership of Dr. Seaman A. Knapp, undertook to establish demonstrations of improved methods of agriculture on farms in that region. The farmers carried on these demonstrations under the supervision of department agents. Meetings were held at the demonstration fields. This plan proved so successful that after a time special agents were located in single counties to supervise the demonstrations and further assist the farmers. To benefit farm boys and girls, clubs were formed whose members undertook some special work at home, such as raising an acre of corn or a pig, or canning vegetables or fruit. Then it appeared that the farm women should have special assistance in their gardening and poultry raising and in conserving and utilizing their products and improving their home conditions. Women agents were therefore placed in counties where funds were available for their support.

This system of extension work spread rapidly in the Southern States until several hundred county men and women agents were regularly employed, with Federal, State, and district agents to supervise them. At first this movement was independent of the agricultural colleges, but gradually they were drawn into cooperation with it. Later a similar system spread into the Northern and Western States, where the colleges took an active part in it.

Maintained at first wholly with Federal funds, it afterwards received for several years much of its financial support from large private concerns, as well as from States and counties.

The general extension movement among the farmers culminated in 1914 through the passage by Congress of the Smith-Lever Extension Act, which made possible a combination of the demonstration work with useful features of the earlier extension work, so as to form a broad system of practical education for the men, women, and children on the farm, supplementary to the training given in schools and colleges. Under this act the agricultural colleges and the Department of Agriculture are made responsible for cooperatively carrying on the extension system, which thus becomes a permanent part of the public system of education throughout the 48 States.

Ten thousand dollars of Federal funds are annually appropriated to each State, together with additional funds allotted to the States on the basis of rural population. The additional funds to be thus allotted began with $600,000 in 1915 and thereafter were increased by $500,000 for seven years, and are now $4,100,000 annually. These additional funds must be offset by equal amounts which may be appropriated by the State legislature "or provided by State, county, college, local authority, or individual contributions within the State."

In the year ending June 30, 1923, the extension work in the States was maintained with $18,821,144, divided as follows:

Federal Government:		
States Relations Service	$1,027,981	
Other bureaus of Department of Agriculture	45,221	
Federal Smith-Lever funds:		
Regular	4,580,000	
Supplementary	1,300,000	
		$6,953,202
From sources within the States:		
To offset Federal Smith-Lever funds—		
Regular	4,100,000	
Supplementary	1,300,000	
Additional funds from States, counties, and other sources	6,467,940	
		11,867,942
Total		18,821,144

Since the passage of the Smith-Lever Act Congress has made annual appropriations supplementary to the regular Smith-Lever funds and also providing the States Relations Service of the Department of Agriculture with funds to be used in cooperation with the colleges and counties in extension work. The States and counties have more than met their obligations under the Federal legislation.

In the relations of the Federal Government with the cooperative extension service the Secretary of Agriculture is represented by a Director of Extension Service as far as general policies and administration are concerned. This service also includes the work of the department with reference to motion pictures and exhibits at fairs and elsewhere. The management of the department's affairs relating to extension work under the Smith-Lever Act and related Federal and State legislation is principally conducted through the Office of Cooperative Extension Work. The chief of that office and his assistants confer with the State extension officers and make arrangements with them regarding projects and plans of work, financial budgets, and methods of conducting the work in the States and counties. They also make arrangements for the cooperation of specialists from the department bureaus in the work in the States. The work and expenditures under the Smith-Lever and department funds are annually inspected in all the States, and when the expenditures are approved by the department, the States are certified to the Treasury Department to receive the next installment of the Smith-Lever fund. The funds appropriated to the department for farmers' cooperative demonstration work are used for the maintenance of the Office of Cooperative Extension Work and for the payment of part of the salary of extension workers in the States and counties.

In the States each college receiving the Smith-Lever fund carries on its extension work through an extension division, at the head of which is a director, who acts as the joint representative of the Department of Agriculture and the college and administers all the extension work in the State. Under him are State leaders of the county work and a force of extension specialists in the various branches of agriculture and home economics who assist the county workers and supplement their work throughout the State. They also prepare publications and illustrative material.

In 2,100 counties out of about 2,650 agricultural counties there is an agricultural agent, in 800 counties a home demonstration agent, and in 200 counties a special agent for boys' and girls' club work. In the Southern States there are 175 negro agricultural agents and 100 home demonstration agents. The white agents also do much work for the benefit of the negro people on the farms. The agents in the counties supervise and conduct demonstrations on the farms and in the homes, hold meetings, and give advice and assistance by personal visits, correspondence, telephone messages, articles in the local press etc.

To support and aid the county workers, groups of farm men and women have been organized. In about 1,500 counties this organization is called a farm bureau. It has a president, secretary, and treasurer, and committees whose members represent different communities in the county. While originally formed to cooperate in extension work, the farm bureaus have enlarged the scope of their work to include the formation of marketing organizations, publishing of papers, and matters relating to business, legislation, and the social concerns of farming communities. The extension workers are not responsible for the conduct of these activities though they may give advice and information regarding them. The farm bureaus often use part of their funds as contributions to the support of the county extension workers. For their larger enterprises State and American federations of farm bureaus have been formed.

In about 600 counties the place of the farm bureau is filled by a county council of agriculture or some other organization of farmers. Throughout the country the extension workers also have helpful relations with many kinds of farm organizations.

In making the annual plans for extension work it is now a common practice for community committees of farming people to meet together with the extension agents and work out a community program. These community programs may then be combined into a county program. Certain features of the county programs may then be taken to form a State program, and this may have certain elements of regional or national significance.

The character of the cooperative extension work is defined in the Smith-Lever Act as follows:

> That cooperative agricultural extension work shall consist of the giving of instruction and practical demonstrations in agriculture and home economics to persons not attending or resident in said colleges in the several communities, and imparting to such persons information on said subjects through field demonstrations, publications, and otherwise.

In subject matter this work covers the whole range of problems relating to agricultural production and economics, as well as the home and community life of farming people. In recent years the agricultural agents have given much attention to standardization and marketing of farm products and the formation of cooperative associations. The home demonstration agents have aided the farm women in increasing and more efficiently utilizing their farm products and incomes, bettering sanitary conditions, preventing diseases, improving household arrangements and equipment, using labor-saving devices, and increasing social welfare.

In 1921 in the organized counties work was carried on in cooperation with clubs, committees, and other groups of farming people in 25,000 communities.

During the year 125,000 community and other meetings were held with an attendance of 6,000,000.

The county agricultural agents, assisted by the State leaders and extension specialists, visited 650,000 farms, on about 250,000 of which they carried on demonstrations with a large variety of crops and animals. In connection with these demonstrations, 75,000 field meetings were held with an attendance of 1,000,000.

The number of farmers who modified their crop or livestock production as a result of extension work was 2,215,000, or an average of about 1,100 per county.

The State and county home demonstration agents carried on 250,000 demonstrations, and as the result of these demonstrations 650,000 women made changes in their home practices. Home demonstration work included many matters relating to food, diet, clothing, household equipment, and management. The girls and women also did much work in gardening, poultry raising, dairying, and food conservation. Special emphasis was laid on matters relating to the health of the farming people and the care and nourishment of children in the farm home.

Five hundred thousand boys and girls were enrolled in the clubs and undertook projects on crop and livestock production, canning, home improvement, etc. Nearly 300,000 of these completed their projects and made written reports.

ENTENSION WORK IN DAIRY HUSBANDRY AND DAIRYING.

Extension work relating to dairy husbandry and dairying is carried on by specialists with headquarters at the agricultural colleges or the United States Department of Agriculture and by many of the county agricultural and home demonstration agents.

The total amount of funds from all sources definitely allotted to dairy extension work for the year ended June 30, 1923, was $312,630. These funds were provided to employ 87 dairy extension specialists to supplement the dairy extension work carried on by the extension agents in the counties.

In 1922, 1,300 of the county agricultural agents reported activities relating to dairying. Among the results of their activities was that 7,650 purebred dairy bulls and 15,000 purebred dairy cows were secured by the farmers to improve the breeding stock on their farms.

The county agents continued to cooperate with the Bureau of Animal Industry of the Department of Agriculture and the State colleges in the promotion of the cow testing associations, with the result that there were 515 active associations with an enrollment of 12,510 farmers owning 220,000 dairy cows.

The agents also reported that 1,500,000 head of dairy cattle were treated for tuberculosis in 1922 as the result of their advice.

There was considerable interest among the boys and girls in dairy club work with the result that nearly 6,400 children completed their work in the dairy calf clubs, 600 in the dairy cow and calf clubs, and 675 in the dairy heifer clubs. In addition the boys and girls were interested in the use of dairy products as health-giving foods. Through special efforts to improve the school lunch 5,200 schools introduced milk as a part of the noonday meal, resulting in both physical and mental benefit to over 200,000 school children. In many communities the extension agents also aided in campaigns for the more intelligent and larger use of milk as a part of the diet of children and adults.

The extension agents were also interested in aiding the farm women in areas where the making of butter is a considerable farm enterprise. In 1922, 3,250,000 pounds of butter were made according to instructions of the extension agents, of which 1,250,000 pounds were sold at a price considerably above that received for ordinary country butter. In addition farm women produced and sold, according to the agent's instructions, 500,000 gallons of cream, and 2,200,000 gallons of sweet milk and buttermilk.

SECONDARY EDUCATION IN AGRICULTURE.

Secondary education in agriculture is given in two types of schools: (1) Special agricultural schools and (2) departments of ordinary secondary (high) schools.

The special agricultural schools are organized as branches of the agricultural colleges or as independent schools in counties or larger districts. Most of these institutions are public schools, but there are also a considerable number of private schools in which agriculture is taught. The special schools usually have their own buildings, farms, livestock, farm machinery, and laboratory apparatus. The fact that they have relatively large equipment for agricultural instruction and more thoroughly vocational courses makes these schools particularly attractive to more mature students who have not been able or inclined to prepare for college, but desire instruction which will make them better farmers. There are now about 170 such schools in the United States.

In general, courses in agriculture covering from two to four years are combined with courses in English, mathematics, elementary science, history, civics, and manual training to make a four-year secondary course. Systematic practice in farm operations is included in the agricultural course.

A department of agricultural instruction has been organized in about 2,000 public high schools in the 48 States and in a small number of private schools. In each school there is usually a single teacher of agriculture. In most of these schools the agricultural course covers only one or two years, but in an increasing number of schools an effort is being made to continue it through the four years covered by the regular high-school program. The instruction varies from that which is largely practical and truly vocational to that which consists chiefly of textbook and laboratory work. Some of the schools have small tracts of land and a few animals, but for the most part the practical work is conducted on the farms where the students reside with their parents, through what are known as home projects.

Since 1917 secondary agricultural instruction has been increasingly influenced by the provisions of the Smith-Hughes Vocational Education Act. Under this act in 1917, $548,000 of Federal funds was allotted to the States on the basis of their rural population for the salaries of teachers and supervisors of agricultural instruction. This amount has been annually increased by $250,000, and this will continue until 1926, after which the annual appropriation will be $3,000,000.

The instruction in agriculture must be of less than college grade and be designed to meet the needs of persons over 14 years of age who have entered or are preparing to enter upon farm work. Each student in agriculture must pursue supervised practice in agriculture on a farm for at least six months per year. The "home projects" of the students usually consist of the growing of some crop on at least an acre of land or the feeding and care of one or more animals for a period of at least six months. The student must keep a record of his farm operations and their cost and make a written report on his project at its completion. The teacher visits the farm to observe and comment on the work. Care is also taken to connect the school instruction with the practical work on the farm.

SECONDARY DAIRY INSTRUCTION.

In the special agricultural schools dairy instruction is commonly given as part of the course in animal husbandry, which occupies from one to two years. The dairy work covers breeds, breeding and judging of dairy cattle, feeding and care of the dairy herd, construction, ventilation, and sanitation of barns, silos, and milk houses, common diseases of dairy cattle and their treatment or prevention, milking and handling of milk under farm conditions, use of separators and Babcock testers, butter making, cheese making, dairy bacteriology, and marketing of dairy products. These schools have dairy herds and barns.

In the local secondary (high) schools having agricultural departments the same general plan of instruction is followed as in the special schools, but the dairy work is usually less elaborate. The amount of dairy instruction will depend largely on the extent to which dairy husbandry is practiced in the vicinity of the school.

In some Smith-Hughes schools short dairy courses have been organized to give practical instruction to farmers and farm boys who are not able to take the regular courses. Students taking dairy courses in Smith-Hughes schools must have at least six months' practical work on their home farms under the supervision of the agricultural teacher. In 1920–21, 942 students in 34 States completed home projects in dairy husbandry, using 3,670 cows, or an average of 4 cows per student.

Chairman Scoville. I am sure I express the regret of all of you in saying that we are keenly disappointed in not having Mr. Sapiro's paper presented at this time. We had hoped to have him here with us, but he is unavoidably detained. We had then hoped to have Mr. Holman read his paper but it was obvious some little time ago that there would not be time so we have not made the attempt. It will, therefore, be read by title and will appear in the published proceedings.

THE COOPERATIVE MARKETING MOVEMENT.

Aaron Sapiro, attorney and cooperative marketing expert, New York City and San Francisco.

There is a particular fascination in discussing cooperation with milk producers. About the dairy industry there lies the appeal of original sources in both the birth and the higher development of the cooperative movement among producers. The dairy farmers of Switzerland were making experiments in producer cooperation two centuries ago.

Of late, perhaps, the most powerful and successful form of cooperative marketing that the world has ever known has been evolved among the growers of the western United States. Within the last decade, and mostly within the latter part of it, this form of cooperative marketing, known as the " commodity plan," has been applied to all sorts of farm crops in every part of the United States as well as on the Pacific coast, and to the marketing of great staples, such as wheat and cotton, as well as to specialty crops. In the last two years it has been applied to the tobacco crop to such an extent that over two-thirds of the entire American crop is being marketed to-day by five great associations which have met with immediate and brilliant success.

Its application to the marketing of milk and dairy products in America is as yet comparatively limited and only a dawning growth; yet the plan itself was first evolved by none other than the dairy farmers of Denmark.

To the man who milks the cow in little Denmark the agricultural producers of the world will owe the economic freedom that is rapidly coming to them through the knowledge and successful application of the proper principles of cooperative marketing. These men produced the long-term binding contract between the individual grower and his marketing association which is the key to the success of the latter. They first worked out the absolutely essential principle of the internal pool, and they were first to see that the aim of cooperation for marketing purposes is not merely a battle against speculators but the development and stabilization of markets, the improvement of the product and of selling methods, to the advantage of the consumer as well as of the producer—in short, what American men of big business call "merchandising."

When the Danish dairy farmers' cooperatives succeeded, against tariff barriers and copious foreign production, in selling their butter in huge quantities to the other countries of Europe; when they accomplished this end solely by the fact that these cooperative marketing societies surpassed, in the quality of their product, even the already famous "Estate butter" of Denmark, and by the fact that consumers who bought from these cooperative societies bought under business methods that brought higher guaranties of quality and higher standards of service to them than they had ever known before, then these farmers taught the true lesson of cooperative marketing to the husbandmen of the world.

Sun-Maid raisins, Sun-Kist oranges, Sun-Sweet prunes—all the glamorous achievements of gigantic cooperative marketing in now far-famed California—owe their existence to the dairymen of Denmark.

The new "Dairylea" milk, now being advertised from end to end of the United States—the branded evaporated milk product of the Dairymen's League of New York—owes its existence indirectly to the same sources. The members of the first modern Danish dairy cooperative marketing organization, established in 1881, would probably receive a thrill of which they never dreamed if they could see the posters advertising "Dairylea" milk in the New York subways and carrying the slogan, "*Guaranteed by 70,000 farmers.*"

The true gospel of successful cooperative marketing contains much more than merely the preachment of a correct form of organization. Without such organization success is impossible; but without the proper use of correct organization success is equally unattainable. There must be full realization that the right aim of cooperative marketing is to substitute scientific *merchandising* for the disorganized dumping of farm products, and the intense application of every effort of the organization to the winning of that goal.

This is so important that it would be well to set forth informally the six cardinal principles of modern merchandising, which are:

1. *Grading*—Grades must be standardized and the standards strictly adhered to. This results both in reliance upon the quality of the product by the consumer, and the improvement of quality by the producer, to his profit.

2. *Proper packages.*—Merchandise in packages has a great advantage over merchandise in bulk. In packaged goods there is uniformity, a higher percentage of preservation, greater ease in handling, the opportunity for the establishment of easily recognized brand names and trade-marks, cleanliness and attractiveness. But the package must be right—different sized packages for different classes of trade, packages that suit the product; their selection is always a task for experts and a field for constant experimentation for better and better results.

The two foregoing principles are recommended for most particular attention by milk producers' associations selling butter and cheese.

3. *Extension of markets.*—Markets for almost every sort of commodity can be expanded both as to time and place. By proper

handling, the period over which a product may be marketed can be lengthened to allow for more orderly sale; and the places where it is sold, and the agencies through which it is sold can be increased. Markets can be greatly extended by direct effort to intensify the use of the product. New uses for the product are sought; the public is educated by the tremendous adjunct of advertising and other means, to both the new uses and the old ones. Advertising is also a great aid in—

4. *The procuring of continuous use.*—Former luxuries, like raisins, for example, have been converted into something like a staple food product in the public regard, by correct merchandising methods applied to this end, and what was an almost wholly seasonal consumption at Thanksgiving Day and Christmas time has been changed to a steady year-round demand.

5. *The securing of even and complete distribution.*—By this is meant the prevention of a glut in some markets while there is a famine in others.

Before successful cooperative marketing came to the orange industry in this country, for instance, disorganized growers and shipping interests, working in ignorance of each other's plans, used to swamp one market, while another remained bare. The result was terrific loss to the producers, both in spoiling fruit and crashing prices. Now the great citrus cooperatives of California and Florida chart every car of oranges moving in the United States, keep up-to-the-minute information on every market, redirect shipments in transit to see that the markets are evenly supplied and not over-supplied.

6. *Making prices depend upon supply at the point of consumption and not at the point of production.*—This can be done when the market movement of a commodity is known to be under control of large and efficient organizations which do not glut consuming markets no matter what the quantity of the produce they may have to dispose of. It can not be done otherwise. When the farmers are disorganized, a time of overproduction, such as we had in the potato crop last year, brings not only the loss of the unassimilable surplus, but drives to a ruinous point the prices obtainable for the part of the crop which is to be consumed. Seventeen million bushels of potatoes, rotting in the ground in Maine last year, made the price on hundreds of millions of bushels of potatoes moving upon the market, all over the United States, because buyers knew that there was absolutely nothing to prevent the surplus at the point of production from coming upon the market if the producer could possibly get it there. Powerful cooperative organization skillfully merchandising a great crop is the only solution for the surplus problem, and, as will be seen presently, this problem is particularly and always the great one to be solved in the successful marketing of milk by producers.

If the relation of cooperative marketing to the milk producer is a fascinating study for sentimental and historical reasons, it is even more so because of the many peculiar and intricate problems which milk presents to the marketing expert. It is the number and depth of some of these problems, especially in America, which has been responsible for the delay in the application of the most advanced principles of successful cooperation to the dairy industry in this country.

Fluid milk is probably the most perishable of the farm products that form the basic food of the world. The distances over which it can be shipped are decidedly limited and the methods under which that transportation must take place are specialized and very expensive. Therefore producers of fluid milk must be organized first about great metropolitan centers, and conditions covering existing milk markets will differ widely among these various centers.

The dairyman producing milk for fluid consumption in these centers, and located near them, must pay higher rentals and use more expensive methods and a more highly specialized equipment than the dairyman some distance away, who produces milk chiefly for manufacture into condensed milk, butter, or cheese. Therefore, it is for fluid milk that the highest return must be and is paid to the farmer.

But let us consider for a moment some of the problems with which the producer of fluid milk is confronted. In the first place he has, perhaps beyond any other producer, a tremendous obligation to his consuming public. Above all things there must always be enough milk for the metropolitan centers which he supplies. The feeding and the health of little children, rich or poor, is the first simple material obligation of civilized mankind.

Now if there is to be enough milk, that means that in addition there must be a constant surplus. And if there is enough milk throughout the year, that means that there must be a very large seasonal surplus, in addition to the regular small surplus, at those periods of the year when the cows produce greater quantities of milk.

It is this surplus and the disposal of it that primarily make the price of all milk and milk products. While milk in fluid form is absolutely perishable, it can be converted into butter which is good for a season, into cheese which is still nearer imperishability, and into condensed and evaporated milk or milk powder which are to-day put up in forms that constitute absolutely nonperishable products. Dairy products, related to the surplus problem, form the key to the intelligent handling of milk.

Without organization for cooperative marketing, and without very powerful and technical organization in each of the great metropolitan districts, fluid milk producers are absolutely at the mercy of speculative dealers in these centers through this surplus problem. During the season of flush production, if the unorganized fluid milk producer will not sell his milk for any price the dealer will name, he will not sell his milk at all. Because it is so much cheaper to produce milk in far outlying districts, the dealer is able to hold over the head of the fluid milk producer, at such times of the year, not only the normal surplus of himself and his brethren, but the surplus of the outlying producer which he can bring into the city as fluid milk.

On the other hand, the outlying producer who makes milk for creamery and factory processing is confronted with the fluid milk producers' surplus in the same markets. The only solution to this problem is a two-fold one: First, the very complete organization of the fluid milk producers about every metropolitan center; and, second, the interlocking organization of all dairy product producers throughout the country properly to merchandise dairy products, attend to their storage as well as sale, and the development of an increasing consumption of such products, the possibilities of which, in America at least, have hardly been touched.

Of approximately 89,000,000,000 pounds of milk, estimated by the United States Bureau of Markets to have been produced in the United States in 1918, 44.25 per cent was consumed as fluid milk. These figures are an interesting comment upon the plentiful use which the American people make of fluid milk, but they are an even more interesting comment upon the woefully undeveloped capacity of the American people to consume dairy products, notably cheese, of which there was manufactured in that year only 400,000,000 pounds—or, at the rate of 10 pounds of milk to the pound of cheese, only 4,000,000,000 pounds of milk, or 4.45 per cent of the total production.

This is less than 4 pounds of cheese per capita per year in the United States. To one who knows the food value of cheese and the volume of its consumption in some of the most advanced countries of Europe, this figure is almost an absurdity. Few other statistics could more clearly prove the immense development of the American milk producer's market for dairy products which awaits the proper merchandising of these products by such skilled and powerful cooperative marketing methods as have increased the American consumption of raisins from 50,000 tons per annum in 1912 to 250,000 tons per annum at the present time.

The reference made just now to the fact that the adoption of proper cooperative marketing methods by the milk producers of America is only a dawning growth, is no reflection upon the initiative or past organization record of these producers. As a matter of fact, in the amount of organization of one sort or another that has been put into effect by our dairy farmers, these farmers lead any other group of agriculturists in the United States. These organizations have accomplished great things against bitter opposition and problems that would have confused any genius. Only that very confusion has necessitated all the experimentation that has gone on in the past to find the solution of these problems, and has prevented, until very recently, a clear conception of the things to be attained and the means to be used.

For example, take the old problem of the possible competition in the fluid milk market of the normal fluid milk producers close to a given metropolitan center and the producers of milk for creamery and factory use at greater distances from that market. While milk producers have long realized the necessity for organization about metropolitan centers, it is only recently that they have also realized that it is necessary for such a metropolitan organization to have within its own ranks a large percentage of the dairymen who are even remotely capable of shipping fluid milk to such a center whether that is their normal outlet or not. And having realized this, the working out of a plan that would amply protect the interests of both the metropolitan producers and the outlying dairymen has presented still further problems. Within the past two years, at least one organization in the Chicago district has solved this difficulty, and others have come to the realization that it must be solved—namely, that milk must be organized about metropolitan centers whether it is produced for fluid consumption or creamery purposes primarily.

Further to handicap proper development, there has been, from time to time, the temporary and unsound success of the wrong kind of organization, with the result that the leaders of such efforts are blinded to their own limitations and oppose improvement until the damage which their opposition causes sometimes costs the dairy farmers more than their former success gained. There have been times, for instance, when some metropolitan organization, in no way correctly organized for marketing but strong in sentimental hold upon its members, has succeeded in bringing about a concession from the dealers in that locality by calling a strike among the milk farmers. Such strikes have only been effective in periods of temporary crisis and have been at the expense, though not so intended, of the consuming public rather than of the dealers. The result is that the milk producers have been burdened with an already unfair amount of public sentiment against them.

With the crisis passed, and improperly organized for the permanent and proper merchandising of their product, except through the dealers who have always had them at their mercy, the milk producers have been as bad off as they were before.

This business of fighting the dealers, as the primary aim of milk marketing organization, is a fruitless one. The proper aim of milk marketing organization, like that of any other cooperative, is to develop and stabilize the market for milk and milk products and to use the legitimate dealer, to his own profit, in the process. That many dealers are short-sighted and do not see their own advantage in such a development is true; but if the organization of milk producers is properly constructed with the merchandising aim in mind it will win its fight against such dealers merely as an incident of its progress, and it will have the support of those of the dealers who understand its powers and possibilities.

I could wish that the American dairy farmer would absorb to the full the lesson of his Danish brother in the matter of the long-term contract. Other American producers have learned that lesson, but it is extremely hard to drive home to American dairymen. The Danish farmer pledges the output of his cows to his cooperative marketing organization for a period of from 12 to 15 years. If American dairy farmers ever did that on the scale on which some of them are now pledging their product to certain great metropolitan marketing cooperatives for 1 or 2 years, the battle of most of the antagonists to these cooperatives would cease almost overnight. The speculators who have made milions out of an antiquated system of marketing are naturally willing to lose a great deal of money for a short period in the effort to see that that system is not transplanted by something more efficient. They would seldom undertake to lose their earnings in a hopeless and unfair fight ranging over a decade or more. They would, instead, turn around and help the cooperatives to develop the vast untouched possibilities in the marketing of milk and milk products, in the attainment of which possibilities their legitimate service is an essential part.

But the proper cooperative marketing of milk or milk products in this country is coming apace. Some of it is already here on a big scale, and the immediate future holds, to my mind, practical results in milk producer cooperatives that will at least equal, if not surpass, those which have been achieved in any other basic agricultural industry in the United States.

Some of the newer milk cooperatives, especially, will already bear most critical inspection with high honor to themselves—organizations like the present Twin City Milk Producers' Association, for example, which, both in its present technique and the goal toward which it is consciously moving, is a most admirable venture.

Furthermore, the tremendous amount of older organization already existing becomes a stupendous asset toward the attainment of such results the moment the leaders of these organizations see and think clearly upon their problem, and there is ample evidence that the great majority of them are doing so to-day. They are not only seeing the problem and thinking upon it along correct lines, but are already acting upon the principles which they have discovered.

I believe our dairy leaders are convinced to-day of the three essentials of true cooperative marketing, for milk or for any other produce—first, the right aim; second, the right technique; and, third, the right personnel. One can not say too often that the right aim is merchandising; and certain activities of the Dairymen's League, for instance, which I have already mentioned, show quite a profound appreciation of the fact. This is one example only—there are others among the existing milk marketing organizations of the country.

By correct technique, I mean the proper form of organization to accomplish the aim. Among its demands are pure cooperation, the binding contract, the internal pool, and organization upon a sufficiently large scale to do real merchandising. There are a number of binding-contract, 100 per cent pooling, milk-marketing cooperatives in existence now, and others are forming. Meantime, we have the very important spectacle of the National Milk Producers' Federation, representing 28 major milk-marketing organizations, indorsing and recommending this new and correct form of organization. Moreover, we have, in various places in this country, groups of formerly independent, and therefore more or less helpless, local cooperative creameries organizing into closely knit, correctly constructed selling organizations for the marketing of their united product; and we have afoot, right now, projects for the joint operation of all these selling organizations in the development of the general market for dairy products.

By the right personnel, I mean the employment of the greatest experts in the business of processing and marketing the milk that the country affords. Such men are to-day being drawn by the score into the service of the dairy farmer. The business of actually attempting to market milk and dairy products along the lines of impractical dreams held before the farmer by politicians, or even efficient organizers with no specialized knowledge in marketing, is rapidly passing. Even those who are to-day engaged chiefly in the attempt to guide legislation or public opinion on behalf of the dairy farmer are beginning to show the mechandising rather than the political point of view in their activities.

An instance of what I have in mind has been the recent brilliant procurement by the organized milk producers of this country of a Government bill to stop the imposition of filled milk upon the milk-seeking children and housewives of the United States. We all know how unscrupulous or misguided manufacturers have been subtracting the butterfat from milk and substituting vegetable oils which give their finished product the feel of milk without giving it the nutritional qualities which have been taken away. The passage of this bill was a boon to the public; but it was also decidedly a boon to the milk producers, and it was the education of the milk producer to the marketing point of view that made him see this and secured his united support to a measure that could never have been passed without such united effort.

Had milk producers a generation ago been properly organized for marketing, and had they had the merchandising point of view and skilled merchandising advice which knows how to handle the possibilities of advertising, they would not to-day be confronted with certain public misconceptions as to the essentials of wholesome milk which have proved a great hindrance to their business. Milk producers were too busy fighting milk dealers and each other to answer, with the scientific truth, misstatements as to the dangers of certain kinds of milk under certain circumstances with which journalistic exaggerations unduly frightened the public for a long period of years.

Furthermore, where, as was frequently the case, scientific investigation did show the necessity for more sanitary and efficient dairy methods, correct organization, with merchandising as its aim, would have seen to the universal application of these methods long before that application actually came.

The public has properly, if a little too amply, been frightened away from the use of undergrade milk. It has never been properly educated in the food values of good milk.

There is a tremendous field of achievement ahead for properly organized cooperative marketing associations of milk producers; and to-day, at last, the long travail of an older order is giving birth to such associations—a race of giants born full-fledged and full-armed to ride forth upon that field and win it.

Chairman Scoville. The National Association of Practical Refrigerating Engineers is holding a conference at Memphis, Tenn., December 12 to 15. Any of you who are going that way are cordially invited to attend.

The Pacific Slope Dairy Show Association will hold its show at Oakland, Calif., October 29 to November 3. An invitation is extended to you to visit that show. These notices will be posted on the bulletin board at Syracuse and anyone interested will please consult them there.

You have had your instructions this morning as to how to assemble for the reception at the White House, and this session will now stand adjourned.

(At 3.50 p. m. the members of the congress went to the White House, where the following address was made by the Hon. Calvin Coolidge, President of the United States.)

ADDRESS BY THE PRESIDENT OF THE UNITED STATES.

The Hon. Calvin Coolidge.

Mr. Secretary, members of the congress: You represent one of the very oldest of the industries. We read that even in the days of Abraham the keeping and tending of flocks and herds was not new, but was well established. Your presence here indicates especially the importance that this industry has attained. It is important in the building up of the race. As a food product, there is nothing which can take the place of that which comes from the dairy. It contributes an important element to the growth and the development, both of the body and mind, for which there has never been discovered any adequate substitute. You meet here as representatives of different States and of different nations. That indicates the growth and the extent of your industry. It began, of course, as a neighborhood affair. As transportation developed, it became national in its scope, and from that it became international, representing a most important human activity. It makes large contributions to our welfare, going into all the industries. It is the support of the packing industry. Different manufactured articles result from the raising and breeding of cattle, going into commerce that reaches from shore to shore, and from nation to nation. Your presence here indicates that it has become a mainstay to commerce and it is a support to friendly international relationship. You do not come representing governments, you come representing people. Commerce and industry are the interplay, the relationship, not between governments, but between groups of different peoples. I take pleasure in welcoming you this afternoon as those who are engaged in an activity for the promotion of human welfare, the building up and the strengthening of all of that which is best in mankind, contributing greatly to the facility of international friendship and the support of a higher civilization.

(Following the sessions in Washington on Wednesday, October 3, the delegates were taken by special trains to Philadelphia, where they arrived on the morning of Thursday, October 4. This was done to enable them to study the methods used by the National Dairy Council in demonstrating the nutritional value of milk. The forenoon was occupied by a demonstration of methods used in the public schools. In the afternoon the delegates were taken on automobile excursions to points of interest in and around Philadelphia and in the evening were entertained at a banquet given by the committee representing the dairy interests of the country.)

SESSION 4. NATIONAL DAIRY COUNCIL DAY.

Honorary chairman, Dr. Aleixo de Vasconcellos, chief of milk section, Ministry of Agriculture, Rio de Janeiro.

Chairman, The Hon. F. P. Willits, secretary of agriculture of the State of Pennsylvania.

Furness School, Third and Mifflin Streets,
Philadelphia, Thursday, October 4, 1923—9.30 a. m.

Chairman Willits. On behalf of the secretary of agriculture of Pennsylvania, the secretary of the Philadelphia Interstate Dairy Council, the president of the National Dairy Council, and of the Interstate Milk Producers Association, we welcome you to this city and to the Nation.

I will now present the Hon. J. Hampton Moore, mayor of Philadelphia. [Applause.]

ADDRESS OF WELCOME.

Joseph Hampton Moore, mayor of Philadelphia.

Mr. Chairman, ladies, and gentlemen: The mayor of Philadelphia extends greetings to the World's Dairy Congress, assembling for a brief period in this historic city. No group could be more welcome than those who compose this visiting delegation. They encourage, produce, and distribute food supplies, without which no great community could long endure. The consumer, who is vitally concerned, is brought by this Congress to a keener appreciation of the service rendered by the producer and the distributor. Without dairy products produced and carefully inspected, communities like Philadelphia, New York, Chicago, or San Francisco would sadly deteriorate. The wonder is that the producer is so well enabled to serve the vast populations which rely upon his product. In a city like Philadelphia, the greater wonder is that the more than 2,000,000 of people may be adequately served, and served daily, in the home and in the refectory, so that domestic as well as business life may be pursued upon an even keel. Still greater is the wonder when one contemplates, in a city like this, the relation of the products of the dairy to the health of the community, the upbuilding of the child, the strengthening of the adult, the improvement and advancement of the race. Truly, it is a worthy group, producers of the sustaining quality of the vitality of a people, who assemble in Philadelphia to-day.

Accept this, if you please, not only as a word of welcome but also as a tribute; for the mayor of this city, the third in population in the United States but the second in industrial importance, realizes full well what it means to have represented here, even for a day, 40 nations, all of them interested in the vital problem of the production and distribution of food supplies. How long could London, or Paris or Berlin, or Moscow, or New York, or Philadelphia, or San Francisco, or Tokio exist without your support and assistance? It is not a new problem but an old one which even the legislators of our various countries have not yet fully solved. A long term in the Congress of the United States taught me something of the problem of production and distribution—the relation of the producer to the consumer—the method of transporting supplies from the soil to the home. Not difficult is the problem to the producer himself within himself, because he can consume and support himself upon that which he produces, but vastly different the problem of the urbanite in such great communities as those referred to or in this city, with its 2,000,000 people. We must have a reliance upon you and your organized and scientific methods. The strength of our children and the health of our people depend upon it. We have not, within the confines of any of our great municipalities, the means to adequately support ourselves in foodstuffs. We must rely, even as you do over yonder in Europe, upon those faithful producers and toilers behind the dikes in Holland down from the Helder, or elsewhere in the fertile fields of your various nations. In this city, for the proper physical upbuilding of our youth and the sustenance of our masses, we must rely upon neighboring counties with fertile farm areas, like Bucks, Montgomery, Chester, and Delaware. In this city of 129 square miles we have left only about 20 or 25 thousand tillable acres, which for pasture purposes must be greatly reduced. Think, then, of the work you have to do in providing for us, and accept our appreciation of your coming to consider the further service you may render. As an observer and one who steals a little time to think about these municipal problems, I greet you heartily and cheerfully as those whose work is closer, perhaps, than any other to nature and to nature's God. If it be a matter of satisfaction to you to know that you are heartily received in this city, which, while third in population in the Nation, we believe to be first in all patriotic and inspirational landmarks and traditions, then accept our renewed assurance because of the useful service you render mankind. You are thrice welcome. [Applause.]

Chairman WILLITS. I now have the pleasure of introducing to you Doctor Vasconcellos, of Brazil. [Applause.] Doctor Vasconcellos is our honorary chairman in place of Mr. Buckley, who is not here.

Dr. ALEIXO DE VASCONCELLOS. In the name of the Brazilian Government, I have the honor to rise and toast this great undertaking that the epic genius of the American people puts forward under the charming style of an epopee. This is, without doubt, one of the most important of the international conferences that have taken place in recent years.

The collaboration of science, business, and commerce in constructing a great work of world interest will show the strength of ideal fed by the noble American spirit of making milk, which is the great gift of nature, the idol of mankind. I know how much the enterprising spirit of this privileged race is capable of. It is enough to see the engineering masterpieces as one travels in this great land, to form a true idea of the great working capacity of the men of this country. In viewing this amazing activity and this gigantic architectural art, all foreigners have the same feeling of wonder, just as they have when they go to Brazil and are faced by the marvels of nature.

The World's Dairy Congress, then, will be one more movement to add to the pile of great works that have been achieved in the United States. I am certain that all the civilized countries are going to profit largely from the teachings of this congress, not so much from what we will see as from what you will show us, as illustrious foreigners, delegates and leaders of the milk industry. Such is the importance of this discussion and the amplitude of the scope that was given it by the untiring committee, to whom I now wish to express my homage, that it gives to milk questions a new phase of extraordinary prosperity.

My country followed with great interest the organization of this congress and hopes to profit from the points cleared up by the discussions in order to introduce improvements into the milk trade, which is to her an important source of income and a matter of vital importance.

In the name of the Brazilian Government, then, I sincerely wish complete success to this great congress. Coupled with this wish, I should like to mention the name of the illustrious president, Mr. Van Norman, to whom I desire to express my compliments and in our name to congratulate all those who have in any way contributed to the success of this congress.

I now have the pleasant duty to salute the foreign delegates who by their knowledge shall contribute largely to our brilliant results I now offer the American people and this great Government my warmest and most heartfelt salutation! [Applause.]

Chairman WILLITS. I have one apology to make and I am sorry to have to make it. The chairman for this meeting, Doctor King, is unable to come, being tied up in his work at Harrisburg. I know what that work is and I am sure he is just as sorry as you and I—I think I am more sorry than anybody else.

I have now the honor of introducing to you Mr. Munn, who is head of the dairy council work of the United States, one who deserves more credit, perhaps, than any, for the work that has been done to educate the public to the value of the dairy cow for the public health. Mr. Munn. [Applause.]

Mr. M. D. MUNN. Mr. Chairman, ladies, and gentlemen: We have endeavored to arrange this program this morning so as to give you a demonstration of what the council work is rather than any address from a member of the council occupying the position that I do; also we wish to have this program move off exactly on time, and it is important that it should do so because of the children who are coming in here a little later to take part in the demonstrational work.

At Washington you had sounded to you the inspirational note of this great gathering, and we wish to add to the volume of that note here in Philadelphia by way of demonstration so that you may carry on with you in your journey to Syracuse the great message which we hope you will receive from this country and which we, in turn, hope to receive from these wonderful delegates from the foreign countries.

This program is arranged so that you will have pictured to you by voice and act some of the work of the National Dairy Council. It carries through the entire day. We hope that by this means we can give you a more perfect picture of what we are doing and how we are doing it than we could by mere addresses.

Another reason why I am refraining from speaking upon the subject alloted to me upon this program this morning is that I am on the program at Syracuse where I shall say what I have to say on the subject assigned to me here this morning, but I do wish you to get this picture so that you may better understand what would be said at Syracuse than perhaps you otherwise would.

I can't refrain, however, from adding just a word to what his honor, the mayor of this great city, said when he referred to the volume of milk consumed in this city. Doubtless you may have had it called to your attention, so I am speaking especially now to the foreign delegates, about the volume of milk produced in this country.

The council has attempted to put in rather concrete form the volume of milk produced in 1922 in this country—100,000.000,000 pounds in round numbers. That does not mean very much in words and figures, but let me put it a little more concisely to you. If we put this milk in 10-gallon cans, the volume of milk produced in 1922 would fill enough cans, placed side by side, to reach ten times around the earth. [Applause.] That milk was all produced in this country. It was mostly all consumed in this country. [Applause.]

I refer to that fact only to emphasize how keenly we realize in this country the important relationship of this great foster mother of man to human welfare.

With this brief outline of the program, I am going to beg leave to defer my remarks until you reach Syracuse so that the time of the program may not be in any way curtailed for this demonstration which we are so anxious should be put on for you to see. [Applause.]

Chairman WILLITS. I now have the pleasure of introducing to you Mr. Balderston, who is secretary of the Interstate Dairy Council of Philadelphia. Mr. Balderston has developed this educational program here and he is at the head of the work in this State. I want to say to you that the work that has been accomplished here is largely due to what he has done. Mr. Balderston will speak to you on "Programs and methods." Mr. Balderston. [Applause.]

PROGRAMS AND METHODS.

ROBERT W. BALDERSTON, secretary, Philadelphia Interstate Dairy Council, Philadelphia, Pa.

The National Dairy Council operates as a national health agency, with branches and local group affiliations in all parts of the country. It derives its funds from regular contributions by the various dairy interests. It cooperates in health education, local and national, and institutes and stimulates many new movements, placing particular emphasis, quite naturally, on proper nutrition.

Its particular contribution to national health is in the dissemination of the knowledge of the newer developments in scientific research in the factors that make for optimum health.

Its educational platform covers the eight health rules, now so generally recognized, which are:

(1) Brush the teeth every day.
(2) Eat fruit every day.
(3) Drink at least four glasses of water every day.
(4) Eat some vegetable besides potato every day.
(5) Drink four glasses of milk each day.
(6) Play part of every day out of doors.
(7) Take a bath at least twice a week.
(8) Sleep long hours with the windows open.

But for the sake of efficiency, it specializes in methods of teaching children and adults proper food selection. Dairy Council work, for convenience, is now clearly departmentalized.

FORM OF ORGANIZATION.

I. The nutrition department is always the most important. In its activities are included:

1. Cooperation in nutrition and other special health classes in schools.
2. Demonstrations of health dishes which emphasize milk and its products.
3. Lectures on health and nutrition to—
    (*a*) Elementary schools.
    (*b*) Women's organizations.
    (*c*) Men's clubs.
    (*d*) High schools.
    (*e*) Professional groups, such as nurses and social workers.
4. Supper clubs for young women, teaching proper food purchasing and attractive preparing for wholesome meals.
5. Essay, poster, and recipe contests.
6. Appropriate distribution of literature and posters in connection with all lectures and talks.

II. The quality control department is second in importance in most centers. It is engaged in educational work with producers, dealers, and consumers to improve the quality of our dairy products. Its program can be outlined as follows:

1. Inspection of milk at farms and collecting plants for—
    (*a*) Sediment.
    (*b*) Bacteria.
    (*c*) Acidity.
2. Farm inspection with score card.
3. Milk plant inspection.
4. Personal visits to dairymen for advice.
5. Educational meetings with lectures and motion pictures.
6. Actual demonstrations of clean, safe milk production.
7. Preparation of appropriate literature for general distribution.

III. The department of health dramatics specializes in health plays, stories, and talks. The value of play and "make-believe" is now recognized as a valuable stimulus in interesting the child in proper life habits, as well as in his general school work.

1. Children are trained to take part in health plays which emphasize the important part milk and its products play in the health of a nation.
2. Adult plays are given with older groups.
3. Stories and talks illustrated by actual objects are given in school assemblies.

IV. The activities of the general publicity department include:

1. Newspaper and magazine articles on all related subjects.
2. Some modest advertising in periodicals and newspapers, billboards, and posters, to acquaint the public with our work and the products we are representing.
3. Attractive educational motion pictures shown in theaters.

V. Financial management. The dairy council is financed by contributions from all branches of the dairy industry. Many interests contribute only to the nation-wide work of the National Dairy Council, while others support a local unit organized for intensive effort in a prescribed area but closely affiliated with and assisting in forming and carrying out the policies of the national organization.

VI. How extensive. The dairy council to-day has 19 branches and affiliated units. A few figures will give some idea of the scope of its work. In one city alone this year the dramatic department gave stories and plays before 190,900 people. The National Dairy Council last year distributed 5,000,000 pieces of literature and reached more than 2,000,000 people in audiences.

VII. The spirit of the organization. The above is a description of the methods through which the dairy council carries on its work, but no organization carrying on educational work can expect to achieve the highest success unless the ideals which actuate the members of the organization are of the highest form. From this you can readily see that any description of dairy council methods gives but an imperfect impression on the printed page, because the spirit of cooperation and idealism can only be expressed in acts, rather than words. That the dairy council workers are imbued with the highest ideals of service is now recognized by all who come in contact with them, from president down to office boy. This spirit of service and maintenance of ideals has been easy to establish because the character of the work invites into the organization the very finest type of workers and special care and effort has been applied in selecting the various workers in the different departments of the organization. The work done by the council has, for this reason, as well as the practical results following, been a distinct contribution to human welfare and a tremendous educational force working for the best interests of the dairy industry.

Chairman WILLITS. I have now the pleasure of introducing to you the greatest dynamic force in any one person that there is in the United States—Miss Jean—who will speak to you on "Health of our school children." [Applause.]

HEALTH OF OUR SCHOOL CHILDREN.

Miss SALLY LUCAS JEAN, American Child Health Association, New York City.

A group of doctors about five years ago, in connection with the New York Academy of Medicine, became interested in the prevalence of malnutrition among school children in America. They formed themselves into a group, adding educators and socially minded individuals, and formed an association to raise the health standard of the American school child.

Their first step was to ascertain whether or not malnutrition was existing in all classes as had been surmised. It was found from studies in existence and from studies that were made at that time that about 20 per cent of the children in the schools of America had malnutrition.

The causes of malnutrition were known and the remedies were known. It only remained to get over the remedies to the children.

How was this to be done? In analyzing malnutrition one of our experts has said "Insanitary surroundings, improper habits of life, lack of sleep, and unsuitable food, all ofttimes due solely to ignorance, may be responsible for just as much malnutrition as is caused by poverty and disease."

That was written about five years ago. It is believed to be true today. With this in mind an attempt was made to reach the children through the teachers. It was found in the very beginning that the teachers themselves had not had sufficient training to teach health to children. Fifty-two per cent of the teachers in America have not been trained to teach. Those are figures of our United States Bureau of Education.

The skeptic said, "How can you teach teachers who have not had any training to teach at all, to teach health? They do not know how to teach, so how can you train them to teach scientific subjects?" And so the essentials of health were reduced to the very simplest terms, with the understanding that we were going to reach this 52 per cent of untrained teachers, as well as the 48 per cent of teachers well prepared.

What are the laws of health, what are the essentials? They are well known to all of us—light and air, sunshine, sleep, rest, proper food, daily elimination, water, play. All of these things make for health.

Yes, but all of these things have been said many times and they have not made much impression. What do we mean by them? How are we to reach the consciousness of these teachers and the consciousness of these children? It was realized at that time that the first step was to develop a method which would interest the child himself, the teacher acting as the teacher of health in interesting the children to practice health habits, following these very simple rules.

Using modern psychological principles, a game was devised that took for its rules the simple laws of health put into the simplest form possible.

We know that a daily bath is desirable, but we also know that the majority of the population don't get a bath once a week. It seemed rather absurd to talk to the busy mother in the country or the busy mother in the city who had to heat her water and fill a tub to bathe her children daily, in addition to all the other duties that were hers. It seemed rather futile to talk to people who had only one tap of water, perhaps not in the house, perhaps water having to be brought from a distance, about cleaning their teeth three times a day.

And so two of the laws that were developed were to take a bath at least once a week and to clean your teeth at least once a day. Others were to sleep long hours, with windows open, and to play out of doors.

The question of foods was much more difficult. But there are some grounds upon which we can all stand and upon which all experts will agree. We know that children must have a certain amount of roughage. They must have a certain amount of vegetables and fruits every day. They must have milk every day. We did not talk about vitamins. It was not necessary to talk of vitamins.

but it was necessary to see to it that vitamins got inside of the children. [Applause.]

And so the plan was devised to put into the very simplest terms these facts that we wanted the children to benefit from. So we said at least a pint of milk every day for every child of school age. We did not talk about butterfats. That was not necessary. We wanted to make them realize that milk had something to do with the things they wanted to do—increasing their efficiency. However, we didn't talk about increasing their efficiency, but we talked about playing baseball and running a race, being able to have a pretty complexion, having glossy hair and a good figure, and all the things that go to make up the desirables of our boys and girls.

The foods that are discussed to-day, chiefly through these rules of the game in this country, and all over this world to some extent, are the vegetables, green vegetables, and fruits and milk, to be taken by every child every day. How has this been done? How has this message been gotten over? That is the great question which we are all asking.

It is not enough for the laboratory to be able to discover the great truths. It is not enough for them to be printed on shiny paper in nice gray covers to be handed out to a few scientific people. We must be able to get over the great scientific truths to the ultimate consumer. [Applause.] The man and the woman of the street, the woman in her home, the child in his classroom must know these things, must feel them, must care about them. As we have stated, it is not necessary to give it to them in scientific terms, but they must have the information and they must have the knowledge whereby we can insure the formation of habits.

Our great Doctor McCollum, who has guided so much of the modern teaching of nutrition in the last few years, has said that "the white bread and other cereals, muscle meat, and potato type of diet which is so common in America and parts of Europe is causing physical deterioration. No animal can grow satisfactorily on a food supply of this type, nor can one remain long in the possession of full vigor after growth has been attained. Only when such a food supply is supplemented with liberal amounts of milk, leafy vegetables, and fruit will it prove satisfactory."

With such statements as that we were quite willing to stand by the idea of the leafy vegetables, the fruit, and the milk for our children—but for *all* children, not for a favored few. Now about the favored few. Where does our work begin? In the largest and most prominent and most expensive private schools of this country the amount of malnutrition is as high as it is on the east side of New York. That is an astounding fact, but it is true. It isn't quite so true now as it used to be; it is beginning to be changed. However, it goes to prove that it is largely a problem of education.

With this in mind, teachers were asked to weigh children once a month and put in the child's mind through the use of a chart which was very simple and which the child himself could use, what he should weigh for his height, giving a standard to him and establishing in his mind an ideal of health. Eighty-four on a piece of paper meant something to the child. Even the teacher who had had no training could understand 84 as a standard and the children could understand 84. When they stepped on the scale and found that they were 62 there was an interest, there was an enthusiasm, to know what was the matter.

As one boy said to me a long time ago in work in a school in a foreign section, "Aw, Miss Jean, watcher think makes me like that?" He was 62 when he should have been 84. Now lots of children are asking "watcher think makes me like that?"

The teacher must be able to answer that question. Mind you, she may not have had the training to be able to answer the question, so we must give it to her in the simplest possible terms. And so we have these simple rules of the game—"Do you do these things, Samuel?" "Do you do these things, Mary?" "These are the things that go to make you strong and big and vigorous."

Please note this: Never has there been for a moment the slightest suggestion that we deal with the 62. We would not talk about the condition that existed except to point toward the goal, the practical ideal which we wish our children to reach. That 84 was before the children, not the 62. The goal was the 84, the rosy cheeks, the strong shoulders, the ability to play baseball, the ability to be strong and beautiful. All of these things were the goal toward which we were working. And our teachers are beginning to understand that this is true.

But how to get the practice of health habits after the child had the goal in his mind? Oh, it is easy enough to know, "Oh, yes, I must do something about this," but habits are not formed out of an impulse. The emotional interests that can very easily be aroused have very little value unless there is some one there who knows and understands and can continue to interest and stimulate until habits are formed.

What are some of the methods? You are practical people. You will want to know how to do this thing, how it can be done better in your neighborhood than it is now being done.

First of all, we must train our teachers, get back into our normal schools and our training colleges. We have had to begin at the wrong end. We knew we were beginning at the wrong end. We had to begin with the child before we had the leaders prepared to teach him, but that was the only way at that time; it is not the only way to-day. Teachers' training centers all over the world are eager to know how to teach health to children, how to train teachers to teach health to children in the very best possible way.

Some of the methods which have been devised are familiar to you and you are to have an opportunity to see a demonstration of them here.

Several years ago Cornell University asked some assistance of the association with which I am connected in preparing and planning an exhibit in connection with the Milk Show in New York. We devised a plan for the teachers to write plays on health. One of them said, "Oh, but teachers don't know. How can they write plays? They are not playwrights and they don't know health."

We gave them the very simple essentials of health and suggested that awards be given to teachers. Not to children, mind you, but to teachers, to encourage their investigations, to encourage their interest, and plays were written. They were to be judged by experts from one of our leading universities, not from what the children said they knew or from what the teachers said that they knew, but from the plays that the children were to give, to demonstrate whether or not the teachers had a sufficient knowledge to demonstrate the possibilities of teaching through dramatics.

I must admit that at the first performance I was a bit nervous because it was the first attempt that we had made to do this sort of thing with a great city school system such as New York. But the children stepped out in their inexpensive little costumes made in classrooms and acted out these plays with delightful spirit and vigor.

I recall particularly one little girl of about 6 who stepped on in a very frilly little dress and bare feet and legs. She did a very pretty little aesthetic dance. I thought, in my dull ignorance, "What has this got to do with health? What has this to do with such a play as this?" Then a boy stood beside her. He had on a gold crown made of paper, and carried a broomstick covered with gold paper which made him a king. As the little girl finished and stepped back the boy said, "Well done, fair maiden, but art thou not tired?" The fair maiden drew herself up to her fullest 6-year height and said, "Tired? Why, no; I don't get tired. I drink milk." [Applause.]

You can't doubt that that child was interested to know something more about milk and what it did for her. Weariness, tiredness, all were tied up in her mind with the positive thought that milk gave strength for work and play.

Of course, we all know that milk alone does not do these things, but we have to teach one thing at a time, and this was a lesson on milk. As you are particularly interested in that subject, you will be interested in some other methods that have been used for teaching the value of milk.

Last year one of the great universities asked the assistance of the American Child Health Association in making a demonstration in their practice school as to the possibilities of teaching health through history to a fourth grade. A well-trained teacher was selected from our staff who had "majored" in history and had been deeply interested in health.

For over one semester she taught these fourth-grade children the possibilities of the lives of the colonial children in comparison with theirs, and how the colonial children lived. That happened to be the period of history that they were studying. It was very interesting to have those little boys and girls name an imaginary little girl of colonial days "Faith," who was represented by a paper doll pinned upon the blackboard on the particular day they were to compare their lives with hers.

What time did Faith get up in the morning? What sort of clocks did Faith use? What did Faith eat for breakfast? What sort of clock do I use? What time do I get up in the morning? What do I eat for breakfast? Those were all quite natural questions for children.

Then came the difficulty of knowing, of discovering just what those colonial children did do in the way of practicing health habits. Unfortunately, our histories in all countries are written from the political point of view and not from the point of view of the people's daily lives. [Applause.] Here may I say I am one who believes that the day is coming rapidly when we are going to teach the children through children of the period and not through the political issues of that particular day. [Applause.]

I would like to quote from that young teacher's outline a little of what she did with these children:

> The children themselves were quick to suggest that it might be helpful, first, to study their own health activities in order to find out the most essential ones to look for in reconstructing the health day of the Pilgrim child. Accordingly, one of the first steps in the project was the memorandum which each child made of those activities he felt to have a direct connection with his own health. Two large yellow clock faces found their way into the classroom and were immediately named by the class "Our health clocks." The numerals for the hours were already marked, but beyond these numerals lay a wide yellow border on which could be pasted pictures of the health activities suited to that part of the day.
>
> The art instructor's help was enlisted in the clocks mounted on a background of black cardboard which bore in yellow lettering an explanation of the clocks. One clock face represented noon to midnight. The other midnight to noon, etc. Together they offered opportunity for the picturing of the complete health day.
>
> The information found relative to the health activities in daily life of the Pilgrim child was organized on a large cardboard sundial compared with the health clocks. The material which could be placed on the sundial was conspicuously limited. There were, however, also advantages in this life. The outdoor occupation, the long hours of sleep, and certain simple foods to which the children were accustomed.
>
> The majority of the children were taking milk in some form or other at home. That they recognized its importance as a food was demonstrated by their excitement on discovering that the first cows were introduced into the Plymouth Colony two years after the arrival of the *Mayflower;* also the attention given the allotment of the first shipment of cows, which Governor Bradford described in his chronicles of the Plymouth plantation, made quite an impression.

I heard those children discussing this afterward, and one little girl who showed a very beautiful picture of a cow (these were 9-year-old children) on a little enlarged drawing that she had made and thrown on the screen, was asked the question, "What did the children do before the cows came?" She said, "Well, they had their mamas, but when they were too old to have their mamas, then they sometimes died."

Now there was quite a connection, as you will see, in those children's minds of the fact that there were no cows there for two years after the landing of the Pilgrims. That was really history teaching, as I see it. It demonstrates the correlation method whereby health can be taught in connection with every school subject.

We don't want 15 minutes a day for health teaching in any of our schools, or half an hour. I would rather have five minutes a week given, through actual classroom work of reading and writing and arithmetic and poster making, what we might call art and music, a real part of their lives, and not, "Now, children, take out your physiologies and we will have 15 minutes"—of torture, as you know. Very little hygiene did we give to our children in those days and very little physiology that meant anything.

How many of us remember any of it? How many of us know how many bones in our bodies? How many of us know how many teeth we have in our heads? But the children of to-day who are being taught by this modern method know what to eat to make the bones; they know that sleep has something to do with being able to stand erect; they know because it has been taught to them day after day, week after week, in what we might call the indirect method—the vitalized method.

Mr. Munn tells me I have three more minutes.

(There were cries of "go on.")

You are very kind. There are two subjects that I have not covered that I want to cover in these three minutes. First, that of how you who are interested in the great industry of milk—in the great dairy industry—can help forward this program in all parts of the world. It is not enough to give it to a few children in America, health should be given to all the children in all the world. [Applause.] We must give all children a vitalized interest in this great matter of health; we must help them to form health habits so that every child in the world may grow strong and vigorous with vitality.

What are the steps? First of all, you can't go into the schools and teach. No; but you can help to arouse public opinion to make possible the right sort of teaching in our schools, a public opinion that will demand from educators and from taxpayers health teaching that is real and vitalized in every school in the world.

How can the milk industry mold public opinion so that every man in the street—every woman in the home—will understand the value of health education in the schools? You can't do it by only trying to get him to buy more milk. That is not the way to do it. Of that I am quite sure.

I have had the pleasure of dealing for the last few years with your president, Mr. Munn, president of the National Dairy Council, and it has been a great privilege because he has had the vision to see that he could not sell milk by telling the people that milk was the only food to make them strong. He has understood that it was necessary to say sleep and orange juice and spinach were just as essential as milk. The public will not be fooled by being told that dairy products will make you healthy. They won't, and you know they won't.

It is not enough. We must have sleep; we must have air; we must have green vegetables; we must practice many health habits; we must have doctors and we must have nurses; we must have all of this program to make a real health program. But an essential part of all is dairy products, as you know. So you can tell the truth about milk and increase its use tremendously and at the same time advance the health movement.

We health workers want to increase its use. You do, too. Our reasons may not be the same, but we can work together if we will each of us be quite fair about the way to do this work. Don't forget that every time you see a health scholarship given to a teacher, a health fellowship given to an instructor in an academy or a college or a university, that the truth about milk is going to thousands and thousands of lives in a way that your commercial advertising could never accomplish. [Applause.]

But I look forward to the day when your own advertising will tell the truth about health. It won't weaken your message; it will strengthen it. It is good sound psychology to tell the truth and the public wants the truth, and you can afford to tell the truth because you have the best and most essential product for building healthy children. You can develop so many methods of health advertising.

I see a woman in the audience, Laura Cauble, who, a long time ago, believed that it was possible to put in milk stations (just as we have drug stores on the corners) so that milk could be sold here and there and everywhere, and that every public school should have its milk station next door to it. [Applause.]

Of course it is possible to do those things, but the first step is for you to stand back of those training teachers to teach health. You can't pay a worker from the outside to come into the schools and teach your subject. But you can help create a public demand for the teacher in the classroom, who has the child five hours a day, to teach health through all school subjects and activities.

We must work through the teacher if we are to build a whole world of healthy, happy, gloriously radiant children.

I thank you.

(The delegates rose and applauded.)

Chairman Willits. I am sure you will agree with me that Miss Jean knows a child and knows what to do for the health of that child.

I have now the pleasure of introducing to you Doctor Broome, who is superintendent of schools of the city of Philadelphia. Doctor Broome. [Applause.]

Dr. Edwin Broome. Mr. Chairman, ladies, and gentlemen: After hearing a large part of this remarkable address to which you have just listened and which brought you unanimously to your feet, I realize that my rôle at the best is the rôle of an anticlimax, and having had a little experience with such matters and having myself as a member of numerous audiences listened to anticlimaxes, I appreciate the necessity of making that as brief and painless as possible.

I have been allowed 10 minutes and, Mr. Chairman, if I speak 1 second over 10 minutes, please jerk my coattail as hard as you can. This coat was made for that purpose. [Laughter.] It was made especially strong for just that sort of use; and it has been utilized before.

THE PHILADELPHIA PUBLIC SCHOOLS.

Edwin C. Broome, Ph. D., superintendent of schools, Philadelphia, Pa.

I know of no subject before the public mind to-day, especially before the minds of those interested in the future citizenship of this country, more important than this whole question of the health and the physical welfare and the nurture of children. We spend much more money in the care of our horses and cattle—that is an old story—than we do upon the care of children.

In our school work we owe four duties to the children: First, the duty of giving them a general, all-round education; second, the duty of supervising their moral conduct; third, the duty of looking after their health and physical welfare; and, fourth, the duty of seeing to it that they are in fit physical condition to take the fullest possible advantage of the education that we require them to receive.

We are interested to-day more especially in that fourth duty, seeing to it that the boys and girls who are sent to us to be educated are put in proper physical condition to profit to the fullest degree by that education.

We have in Philadelphia an ambitious program of nutrition and health building. I can't go into all the details. I can simply say in so far as we know it is as extensive a program as any large city in the United States has.

At present we are not able, for lack of facilities, to carry out more than about 50 or 60 per cent of that program; but what is being done, we have reason to believe, is being done well. At any rate, it is being done with splendid spirit and with the full cooperation of many agencies, including your own, without which there would be no success in this work.

We have seven classes for the incipient tubercular children scattered throughout the city. We have eight classes that we call the regular nutrition classes with rest periods, open windows, lunch in the middle of the day, physical and nurse attention. There are about 80 of what are termed "nutrition-instruction classes." That is to say, the children come one hour a week as a class into a room with their parents, where they are weighed and measured and instructions about diet, home care, sleep, and exercise are given. The weight charts of the children are kept, the parents instructed; altogether, this sort of work is very helpful indeed.

We have also the milk service. We are dispensing approximately 9,000 quarts of milk a day to the children of the public schools of Philadelphia in half-pint containers. You can readily see that that will take care of 35,000 or 36,000 children a day in the way of giving them a partial milk diet.

We are spending about $15,000 a year on various forms of food for various types of children. That money comes from different sources, and is managed by the Philadelphia Public School Food or Health Service, an organization within our own group.

Here are some of the results we can prove are being secured: First, last year there was an average gain of weight of all the children in the tubercular and nutrition classes of about 8 pounds per child per year, and, secondly, we are reaching about 1,500 in the tubercular classes, about 1,500 in the regular nutrition classes, and we have about 80 classes of 40 each on the average who are having the weekly nutrition instruction above described—probably an average of 3,000 to 3,200 at any one time receiving that sort of instruction.

I should estimate that by these organized efforts we are reaching about 6,500 children a year. In addition to that, our milk service reaches perhaps 30,000 more. It is safe to estimate that through these various lines of activity for improving the health, nutrition, and the power to withstand strain and to participate in the work of the schools, we are probably reaching roughly 40,000 children a year.

Now what are some of the considerations in this line of work? Compulsory attendance means compulsory health. The corollary to compulsory attendance should be compulsory health. People are constantly setting up the straw man of paternal government, of pauperizing the people; and at the same time they pass laws requiring that every boy and girl from the age of 8 to 16 shall attend school during the entire time in which the schools are in session. We know that a large percentage of those children may attend school. But they don't get a full measure of education, and they don't get it because they are not in a physical condition to receive it.

The intention of the law is to see that every boy and girl gets a thorough American education; and in the enforcement of the law, it is just as much our business to see to it that as many as possible are in fit physical condition to receive that education.

That is the principle upon which we are operating, upon which all are operating throughout this country where they are doing this magnificent kind of work. It is a sound and simple principle that will bear abundant fruit, and the one which I hope will be adopted and carried out throughout the length and breadth of our land.

We can not do too much for these children. There is no greater expense upon a community or a State than having as public charges people who in their childhood might have been rendered strong and well and physically capable of taking care of themselves. We mean to do that through this health and nutrition work in Philadelphia as widely as they are doing it in any city in the United States.

Lack of proper facilities and funds have made it impossible for us to carry out the program, but we are moving along by leaps and bounds. Every year we are able to show an increase of 25 or 30 per cent in the scope of this work, and if you will come to Philadelphia two or three years from now, if we are all spared and are permitted to go on at the rate we are now going, we hope to show you the most creditable results that can be seen anywhere.

I am glad to have this opportunity this morning. I want to thank you personally and officially for the splendid cooperation that we have received through the Interstate Dairy Council to make this work possible and profitable. [Applause.]

Chairman WILLITS. We seem to be limited in our time. Therefore it will be necessary to read, by title, the papers by Mr. Cohee and Mr. Wentworth.

Mr. BALDERSTON. We are now going to have a typical demonstration of what the dairy council has been doing for the past three years. These children whom you will see have been trained at only three rehearsals of an hour each. Two weeks ago we didn't know what children we were going to have. There isn't anything you will see to-day that is cooked up, fixed up, for this performance. Each one of the demonstrations is just exactly as it has been put on in these schools day after day for the benefit of the children and their friends.

The next number is a food value story with objects, which will be given from the platform by Miss Lillian Conwell, of the Pittsburgh District Dairy Council. She will talk to the children here just as if the rest of us were more children in the back of the room.

DEMONSTRATION OF SCHOOL WORK.

FOOD FAIRIES.

Miss Conwell. I am going to try to demonstrate to you one of the health lessons that we give throughout the schools in our district as well as in the Philadelphia district and, I think, by a couple of other councils. The lesson is the type of lesson that we want to give to everybody; not only to children. As Mr. Balderston said before this morning, I hope that every man and woman here will imagine that he is back—well, 10 or 20 or 30 years, or how many years you have to go back [laughter] to be a child again, so that you might get the lesson, perhaps, just a little bit clearer or just a little bit differently from what the man or woman would.

I will probably talk to the children more than I will to the men and women, but I hope you will forgive me for that because I want reaction; if you have any reaction to give, I will be glad to have it from you, too. [Applause.]

I want you boys and girls to answer me, if you have an answer to make, when I talk with you because I want to tell you a story.

Good morning, boys and girls.

Children. Good morning.

Miss Conwell. I am glad to see you here and I am awfully glad to tell you about the little friends that I have brought with me this morning. You all know about fairies, don't you?

Children. Yes.

Miss Conwell. You all know that fairies are pretty nice to you, don't you?

Children. Yes.

Miss Conwell. Well, I want you to know that every little boy and girl has a little house of his own that he has to help to make grow, and these little fairies that I have with me this morning are going to tell you how you might make this house that you have grow just a little bit better, a little bit stronger, a little bit bigger, perhaps, if you do what the little fairies say.

These little faries are fine fairies. We have all kinds. We have the kind with wands that change the different things into other things. We have the Christmas fairy—and you know that fairy, don't you? We have the Easter fairy. You all like them, don't you? But the fairies that I have with me this morning are good fairies, the kind of fairies that make this house (indicating the body) that we live in grow a little bit stronger.

The first little fairy I have is this little fellow. You see he is pretty strong looking, don't you? I asked him what his name was and he told me that his name was Peter Protein. I said, "Well, what do you do for boys and girls?" He said, "Oh, I make boys and girls strong. I give them something in their arms so they can play."

What do you get in your arms?

Child. Muscle.

Miss Conwell. He said, "I give boys and girls muscle so they can be strong." Then I said, "Well, where do you live that they might get this muscle?" He said, "I have a pretty good home in meat." I said to him, "Well, I will put you in meat for a little while, but I think we can find a better home for you than that."

So I brought this little meat house for him to live in. It is really truly meat. I want you to see what is on the outside of this meat. What is on the outside of this meat? What is it?

CHILDREN. Fat.

MISS CONWELL. So we will put little Peter Protein in his meat house for a little while, but I think we can find a better home for him later on.

Then the next little fairy that came was this little fairy. I asked her what her name was and she said, "My name is Fannie Fat." I said, "Well, what do you do for boys and girls?" She said, "Oh, I make boys and girls nice and fat; I make them nice and chubby and give them nice big fat cheeks and I keep them warm, too." I said, "Well, where do you live?"

Where do you suppose she told me she lived? Anybody know?

CHILD. In butter.

MISS CONWELL. Yes; in butter. There it is. So we are going to put the butter house down there for her to live in. Then she told me she lived in another house. Fat—she said she lived in fat of the meat. I am going to put Fannie Fat down here with the fat of the meat for a little while. I wonder how many boys and girls, when mother gives them a piece of meat with fat on it, cut the fat off and push it over to one side? How many do that?

(All the children indicated that they did.)

MISS CONWELL. We are not going to do that any more because Fannie Fat helps us to get fat and she keeps us warm. We are going to let Fannie Fat stay there for a little while, but I think we can find a better home for her, too.

Then this little fairy came along. I said to her, "Well, what is your name?" She said, "My name is Minnie Mineral Matter." I said, "What can you do for boys and girls?" She said, "Oh, I make boys' and girls' bones grow. I make them nice and tall and hard so that they can stand up nice and straight." I said, "Well, where do you live?" She said, "I live in all of the vegetables."

So I brought some vegetables for Minnie Mineral Matter to live in and I am sure you are going to tell me what these vegetables are. I am sure you know what this is.

CHILD. Lettuce.

MISS CONWELL. Minnie says that she lives in that for boys and girls and I am sure you know what this is.

CHILD. Spinach.

MISS CONWELL. Yes. She said she lives in spinach, too. I am sure you know what this is. It is carrots. I also call carrots the "little miners" because they dig way down into the earth and get all the minerals that help to build this house of ours. There is iron—and you know you need iron to keep your blood in good condition. You could not take a piece of iron and chew it and get the benefit of it.

Then we need some lime to help to build our bones and make them hard and to make our teeth nice and hard. You could not eat a piece of lime and get it in here, could you? So we have to ask all these little fairies in the vegetables to help us out and then I am sure you know what these are?

CHILD. String beans.

MISS CONWELL. Yes. You all like string beans and peas and all those other things. There are the potatoes and the carrots and the beets and the onions and the parsnips and the lettuce and the spinach and the kale and all those other things that mother gives you at times. This little fairy says she lives in all these things and she builds the foundation of our bodies so we can stand up nice and straight and have a good posture.

So we will put the little house down here for Minnie to live in for a little while.

Then this little fairy came along. I asked her what her name was, and she said, "My name is Susie Sugar." I said, "Well, what do you do for boys and girls?" She said, "I give boys and girls energy so they can go and run and play and do all the things that boys and girls want to do." I said, "Well, where do you live?" She said, "I have lots of homes, but my best home for boys and girls is in fruits."

So we have brought a fruit house for her to live in.

Then she said she lived in cereals, too. We have all kinds of cereals, breakfast cereals and things like that, and then we have another kind of cereal that perhaps some of us don't know so much about, and that is the cereal bread. Do you know what kind of bread that is?

CHILD. Rye bread.

MISS CONWELL. No; not rye bread.

This is whole-wheat bread. I wish that mother would buy whole-wheat bread for you. If you don't have it, ask mother to buy it for you. Susie Sugar and Fannie Fat and Peter Protein live in here, so it must be pretty good, don't you think?

Now, Susie Sugar says that she has another home, but before I tell you about this other home I must tell you something about the home, because this kind of a home is only good for boys and girls at times. It is the kind of a home that lots of boys and girls like, too, but I am afraid they don't get it at the right time. I am sure you know what this is. Do you know what this is?

CHILD. Cheese.

(Candy was wrapped in tinfoil.)

MISS CONWELL. No; chocolate. It is the candy home. Susie Sugar is always shy when she tells us of the candy home, because she knows that boys and girls get a candy home too often and not always at the right time. The best time for the candy home is after supper, after dinner, for dessert. That is the right time for candy home. So we will put the little candy home down here, too, for Susie to live in for a little while.

Then I had another little fairy come with me and it was this little fairy. I said to her, "What is your name? You look so nice!" She said, "I am Viola Vitamin." I said, "Well, what do you do for boys and girls?" She said, "Oh, I give them life and health and strength and everything that boys and girls need to make them big and strong and happy." I said, "Well, where do you live?" She said, "Well, I live in all the houses that boys and girls ought to have. I live in the vegetables; I live in the fruits; I live in the cereals."

So I didn't bring any home for Viola to live in. I am going to let her visit all around because I always call her the Queen of the Fairies. She just has a home with all the food fairies, so we will put her down here with the rest of the fairies for a little while.

After I was through talking with all these little fairies and they told me all about their houses, Peter Protein said to me, "I don't live in meat for boys and girls; I only live in meat for mothers and fathers." I said, "Well, where do you live for boys and girls?" And where do you suppose he told me he lived?

CHILD. In milk.

Miss CONWELL. Milk; yes. I was so glad that he told me he lived in milk that I brought a milk house for him to live in. I am going to take Peter Protein away from the meat house and I am going to put him in the milk house, because he says if boys and girls drink milk every day they will get the muscle and the strength that they need to make them strong, so they can play and do the things that boys and girls want to do.

Then little Fanny Fat said, "I don't live in meat, either, for boys and girls; I only live in meat for fathers and mothers."

What part of the milk do you think she lives in?

CHILD. Cream.

Miss CONWELL. Yes; she lives up here in the cream. She is all dressed up for it, isn't she?

We are going to put Fannie Fat up in the cream of the milk because that is where she wants to live.

When we are getting a drink of milk at home, let's ask mother to shake up the bottle so we can get a drink of all of it, because we need all of the milk to make us grow.

Then little Minnie Mineral Matter said, "I live in that milk house, too." I said, "But what shall I do with your vegetable house?" She said, "Oh, don't put the vegetables away, because boys and girls need vegetables every day. It makes them healthy and strong. It makes their bones grow and their teeth grow. It regulates their bodies, and every vegetable that mother cooks boys and girls must learn to eat."

The little Susie Sugar said, "I live in that milk house, too." I said, "What shall I do with your houses? You have several to look after." She said, "Oh, don't put the cereal house away because boys and girls should have cereal every day. And don't put the fruit house away because boys and girls must have fruit every day; but take that candy house and take the meat house and put those houses away because boys and girls don't need candy every day; just once in a while, and then they will be lots better if they depend on what they get in the vegetables and the fruits and the milk."

And then Viola Vitamin said, "I live in that milk bottle, too." And I am going to put her up here besides Fannie Fat because, she says, it is the cream in milk that makes boys and girls grow and look the way they want to look.

Now we have all of these little food fairies in their other home. They have homes here, too, but they all live in the milk house. I wonder where you can find them all the time when you want them all together?

CHILD. In the milk.

Miss CONWELL. Yes, in the milk.

Each one of these little fairies in the milk and all these other things help to make this house grow. This little fairy makes the foundation of the house, makes our bones grow so we can stand up straight. We would look awfully funny without bones, would't we? We couldn't grow at all without bones. Then this little fairy comes and covers our bones with this nice flesh and keeps our house warm. And this little fairy comes and gives us the muscle we need so we can be good and strong, and that little fairy comes to give us energy so we can run and walk and play and do the things that boys and girls want to do.

This little fairy comes and makes us bright and happy and gives us nice rosy cheeks, gives us nice shiny hair, and all the other things we need to make us look nice.

Now we have all the fairies in one home. Where is the best home for the fairies?

CHILDREN. In the milk.

Miss CONWELL. And where is the best place for the boys and girls to get the fairies?

CHILDREN. In the milk.

Miss CONWELL. In the milk bottle.

Now I would like for you to tell mother about all these fairies. I would like to have you tell her about each one of these fairies and tell her just what they do for this little house that each boy and girl must help to make grow, and then I am sure if we do all the things the little fairies tell us and drink the milk, which is the home of all the good fairies, we are going to grow to be the best boys and girls that we can be. [Applause.]

(A chalk talk on "The relation of diet to sound teeth" and a play, "Milk Fairies," were then given.)

(Adjournment.)

(Papers read by title):

QUALITY CONTROL WORK OF THE DAIRY COUNCIL.

CURTIS I. COHEE, JR., Philadelphia Interstate Dairy Council, Philadelphia, Pa.

Because of the importance of milk in the human diet, and because the safety of the milk supply bears such a close relation to public health, the dairy industry has important responsibilities for the quality of the product which it produces and distributes. For this reason, the Philadelphia Interstate Dairy Council soon organized a quality control department to cooperate with all other agencies in improving the supply of the territory in which it is operating, and other local councils have been closely following this example.

Two methods may be used to secure a safe supply of milk of good quality. One method is through the enforcement of regulatory legislation. Undoubtedly such legislation has, in many cases, resulted in great improvement in quality, and a certain amount of regulation is necessary as a guaranty that minimum standards will be complied with; but it is a recognized fact that if the cooperation and interest of the producers of milk can be secured and maintained through the means of education, progress will be made far beyond the result of a system of dairy inspection maintained by public officials. However, as this educational program proceeds, these minimum standards can be raised and, supported by public opinion, may be rigidly enforced in the cases of careless individuals.

EDUCATIONAL METHODS EMPLOYED.

1. Through sediment tests of the farmers' milk, the careless producers are discovered and given special personal encouragement, and the more careful commended and encouraged. Reinspection of this kind discloses consistent improvement throughout the territory. Some 25,000 such tests have been made in one year at plants supplying Philadelphia.
2. Educational meetings, in cooperation with the State and agricultural extension forces, county agents, the producers' association, and other agencies, are held at all points where it is possible to secure an adequate audience. A most important feature of such meetings is the use of educational motion pictures, showing how to produce milk of a satisfactory quality, supplemented by short talks by the field men of the council and others. These field men travel by automobile, carrying motion-picture projector and generator, so it is possible to hold meetings in the open air or in any roadside schoolhouse. The dairy council produces its own motion pictures. About 150 such educational meetings have been held during the past year, with audiences amounting to 25,000 farmers and their families.
3. Barn inspections are made where it seems desirable, and advice given for improving both equipment and methods.
4. Two booklets have been prepared, printed, and distributed dealing with the production of clean, safe milk.
5. Demonstrations are held wherever advisable, at which our field men perform all operations of milking the cows and the subsequent care of the product from the barn to the cooling station. As many as 75 farmers attended one of these demonstrations.

RESULTS.

Results obtained show constant improvement in the quality of the milk delivered. We have helped lower the average temperature of the milk, have eliminated very largely the visible dirt, and have reduced the number of bacteria in the milk.

A spirit of rivalry is maintained between various communities in endeavoring to see which can supply milk of the best quality. It is no unusual thing to find that now farmers themselves will frequently visit and talk with their neighbors who have not been careful in the matter of producing clean milk, knowing that the milk of all dairies of a community is mixed together and should one of their number be producing an inferior article it would tend to lower the quality of the combined product of all.

The improvement in the quality of the supply of milk through cooperation and education, in addition to suitable legislation, has proven its worth in every territory where carried out, and it is doubtful if similar results have ever been accomplished elsewhere at so low a figure from the standpoint of financial expenditure. We have fully demonstrated through the educational work of the quality control department of the dairy council that careful production insures satisfied customers and better market conditions for the producer's milk.

RESULTS OF DAIRY COUNCIL WORK.

W. Allerton Wentworth, secretary, Ohio Dairy Products Association, Columbus, Ohio.

There are two methods of measuring results of the work of the dairy councils in the United States. The first measure is interpreted in terms of health and the second is interpreted in terms of increased dairy products consumption. The first is all important to human welfare. The second is important to all engaged in the dairy industry. The first we might possibly term "philanthropic"; the second may be termed "commercial." There is, however, such a close relationship between the two that one can scarcely be discussed without consideration of the other.

There is probably no method available at the present time to nationally measure results of better health. Hence, of necessity, we must deal in terms of individuals, or groups of individuals in a local community. Naturally these individuals or groups in a preponderance of cases are children of school age or preschool age.

I. INTENSIVE HEALTH CAMPAIGN.

In Dauphin County, Pa., the extension service of State college conducted a survey and a year's intensive health campaign in which the dairy council was asked to cooperate by assuming control of certain phases of the project. The survey, when completed, gave such accurate data on conditions and the results were so satisfactory that the plan of cooperation is a model for campaigns of its kind.

The survey showed only 11 per cent of all school children seriously underweight in towns where health education was being conducted as compared with the average for the country, which is 33 per cent of all school children seriously underweight. It is noteworthy that in these towns the children were regular milk drinkers.

II. NUTRITION CLASS WORK.

Nutrition classes particularly emphasize results in improvement of health in the individual child. One example out of many hundreds will be given here. "Jennie, a pale listless girl when weighed, was 17 pounds, or 15½ per cent underweight. She entered a nutrition class in the spring. After 10 weeks she had gained only 1 pound, but that was the start. She gained slowly but steadily from that time until school closed. Her mother 'carried on' with her during the summer and in September when she returned to school she not only had gained 17 pounds and was up to weight for height and age, but had become an active, alert, happy girl."

III. SCHOOL WORK.

School work is of three classes:

That in which the dairy council cooperates with a school health program already in operation.

That in which the program is initiated and supervised by the dairy council.

That in which the dairy council is responsible for the health education part of the program.

The New England Dairy Council, through efforts of the first type, reports 50,000 school children drinking milk. In almost 100 other communities cooperation between the local dairy council and the educational forces has accomplished results of an outstanding nature in the use of milk and educational material in the schools.

A series of nutrition classes, organized as a demonstration in the suburbs of Philadelphia, developed into a school-wide plan. The spring work a year ago in the nutrition classes reduced the serious underweight for the whole school 10 per cent. This year as a result of the school-wide health program throughout the township the serious underweight has been reduced 50 per cent, meaning that today only 9 per cent of all the children in the township are more than 10 per cent underweight for their height and age. It is interesting to note in this connection that all schools of all surrounding townships, and some private schools, have this year adopted the mid-morning milk service in the schools.

The medical inspector of the Trenton public schools asked a representative of the dairy council to give a series of object lesson talks under his direction in all the schools. A series of five lessons were given to the 16,000 children in Trenton.

IV. OTHER ACTIVITIES.

1. *Mothers clubs.*—The mothers of children in nutrition classes under the public-school system of Philadelphia were organized into 43 groups. A dairy council representative was given the responsibility of teaching to these groups, by actual demonstration, the preparation of simple, nourishing dishes with milk as a basis. These mothers, especially foreign mothers, responded unusually well to this form of teaching. Over 2,000 families were reached in this way. In addition the dairy council is cooperating with other agencies, namely the department of public health, in health centers with the same type of demonstrations dealing with the preschool child.

2. *Parent-teacher associations.*—Cooperation with parent-teacher associations is a regular part of the dairy council's program wherever they are active. One outstanding project is typical: In Bridgeton, N. J., after a health talk by a dairy council worker, the parent-teacher association assumed responsibility for the health program in the community. In three months they had reduced the serious underweight nearly 40 per cent, had 50 per cent of the eye defects corrected,

inaugurated milk service in the school, and ended their program with a city-wide "clean-up" and health week.

3. *Supper clubs.*—For obvious reasons one of the most difficult groups to reach in health work is that of the young employed woman and the girl in industry. To meet this situation, supper clubs of 20 to 25 each have been organized. In St. Paul last year 362 girls in industry attended supper clubs. Philadelphia recently inaugurated this program with four groups of 25 each.

4. *Park booths.*—In Pittsburgh the dairy council has two booths in the parks for weighing and measuring children and giving a health message. Last year 7,500 children were weighed and measured. This year, in June alone, 12,000 children have been weighed and measured.

5. *Dairy dish contests.*—A piece of city-wide publicity that kept dairy products before the public for some weeks was the dairy dish contest projected by the St. Paul Dairy Council this year. This contest was conducted through the newspapers. One thousand housewives, chefs, etc., competed in this contest and over 300 dishes were exhibited for the final judging.

6. *Child-health day.*—The St. Paul Dairy Council, with the cooperation of the other health organizations, has established in that city an annual child health day. At this time the entire city is given over to the subject of making children healthy and keeping them so. This is one of the most successful city-wide projects.

V. DRAMATIC WORK.

Health plays are utilized through the dramatic department to arouse interest in and to stimulate enthusiasm for health practices. Many permanent health projects have resulted from these performances. The wide distribution of milk lunches in the Philadelphia schools can be traced in many cases to health plays.

In Atlantic City, after the Milk Fairy play, the consumption of milk by the children in the school doubled in one week.

In addition to performances in schools, health plays have also been given in department stores, industrial plants, with the Girl Scouts, the Y. M. C. A., the Y. W. C. A., and nutrition camps.

It is impossible to estimate adequately the results of dairy council work at the end of a three-year period, since its methods are such that the effect of its efforts are continuous and cumulative. The dairy council, with other health organizations, is engaged to-day in a permanent educational program to fix in the minds of parents and children alike that a strong, healthy body is the best prevention against disease and sickness, and to teach them how to get and keep a strong, healthy body. Through conspicuously successful work, the avenues for bringing its teaching before all types of people are now open, and it looks confidently forward to the time that the menace of undernourishment in children will be reduced to a minimum or will be eliminated. Only then will it feel that its purpose has been achieved.

This leads us to the second result, namely, increased consumption. There is an abundance of evidence showing a stabilized market for dairy products as compared with other food products during the past five years. This has been brought about by increased consumption, a fact which prevails much more distinctly in dairy products than in other foods (unless it be a few of the vegetables and fruits upon which accurate records are not available). To give any thorough report of figures on consumption would require too much detail for the time afforded, so I refer you to scattered examples and the national figures.

The consumption of milk in Boston from 1918 to 1922 increased from 146,300,000 quarts to 178,400,000 quarts, which is 22 per cent in five years. Of this 5½ per cent increase was accomplished in 1922 over the immediately preceding year. This increase in milk used is approximately five times the increase in population of Boston.

In Pittsburgh, 590,000 people used 9,000,000 more pounds of milk in 1922 than in 1921, again an increase materially larger than the population increase. In St. Louis another method was used to determine increased milk utilization. This method was a survey of 600 typical homes. In these homes 19 per cent more milk was being used than in the preceding year. At St. Paul, where the Milk Producers' Association has very accurately recorded milk sales through distributive channels, 26,253,000 pounds of milk were sold during the first seven months of 1923 as compared with 22,268,000 the same period of 1922, which is an increase of 18 per cent. These are not reported for the spectacular feature of the accomplishment but because they are distributed geographically and represent circumstances in territory where the work of the dairy council has been of longer standing.

Nationally, the result may not be attributed entirely to the work of the dairy council but logically much can be credited thereto, and certainly when the whole economic aspect of food consumption is studied as influenced by increased production, producers' financial returns, and consumers' purchase prices, a tremendously favorable situation prevails.

It must be sufficient, because of circumstances, to merely call your attention to the fact that since 1918 the average per capita consumption of milk has increased from 41 to 50 gallons, and of butter from 14 to 16.7 pounds. These two commodities represent 87 per cent of all dairy products produced in this country. The increased use of these products is reflected in others.

The interlocking relationship between these results is such that it is almost impossible to deal with one without discussing the other, and each of them, from the point of view of the educator, the housewife, the mother, or the dairyman, should redound to his satisfaction.

BANQUET.

Toastmaster, M. D. Munn, president, National Dairy Council.

Ballroom, Bellevue-Stratford Hotel,
Philadelphia, Thursday, October 4, 1923—6 p. m.

Toastmaster Munn. I am quite certain that I express the united and profound feeling of all those present when I say that we deeply appreciate the splendid hospitality and courtesy and consideration that have been shown to us here by the people in Philadelphia who have supplied this splendid entertainment. [Applause.]

Those in the industry who have done this have the satisfaction of knowing that they have given great pleasure and gratification to us and I am sure have rendered a splendid service.

I wish those here to understand that the work of the council could not be so successful and far-reaching as it is—in fact, I doubt, if we could make much headway—were it not for the great service that the young men and the young women who are identified with this organization are rendering in carrying on their work. [Applause.]

There has grown up here a spirit of loyalty and service that I have never seen equaled anywhere in all my life. [Applause.] While it is impossible to name each one—and they are all entitled to credit—it is my privilege at this time to refer to one who is responsible almost entirely for what you will see this evening in so far as the presentation is concerned, and I want to further say that the play you are going to see this evening is being presented for the first time. In fact, I doubt if there are half a dozen outside of those taking part who have ever seen it presented, or even rehearsed. It is the hope of all of us that it will be successful, as we feel sure it will be.

In the meantime I wish to present to you Miss Del Rose Macan, whose tireless effort and genius have made this thing possible. [Applause.]

Miss MACAN. May I add just a word of appreciation to Mr. Munn? Never in my experience have I presented my plays to a more appreciative, enthusiastic audience. It has helped the children, I know, and the grown people too, who will perform for you this evening.

This little play that we are going to present to you is the result of several years' thinking. That is, we have had plays that have appealed to girls primarily. We have never had a play that I felt was quite a play for boys, but I think we have one to-night that will appeal to boys, both old and young. [Laughter and applause.]

The boys who are going to take part are just like this back of the stage. I am not going to delay them, but if you really and truly like it at the end of the play, I shall introduce to you the author.

Thank you very much. [Applause]

(The play, "Health Circus," was then presented.)

Toastmaster MUNN. Ladies and gentlemen: This radio apparatus you see on my right was put up here for those speakers who follow me. What they say here to-night will be heard in Canada, California, New Mexico, and every State in the Union.

Before proceeding with the regular program I wish to present Prof. John Price Jackson, the executive director of the Sesqui-Centennial Exhibition Association, who desires to present a suggestion to this gathering. [Applause.]

Prof. JOHN PRICE JACKSON. I was instructed, men and women of the World's Dairy Congress, to present this letter to my old personal friend, Professor Van Norman, who has done such a wonderful job in this day and generation.

[Reads:]

H. E. VAN NORMAN, Esq.,
World's Dairy Congress,
Philadelphia, Pa.

MY DEAR MR. VAN NORMAN: I am instructed by the authorities of the Sesqui-Centennial Exhibition Association to invite the World's Dairy Congress, and its members, individually, to take part in the great celebration and exhibition which will be held in Philadelphia in 1926, to mark the one hundred and fiftieth anniversary of the signing of the Declaration of Independence.

This celebration is to enable the people of America, and the world, to rededicate themselves to the fundamental principles of human liberty and square dealing and to the promotion of international and internal welfare, peace, and happiness.

The celebration will be in the form of great congresses of people interested in all lines of human endeavor and an exhibition of the progress of civilization; it should be of special value to those engaged in agriculture and dairy husbandry.

It is, sir, with great pleasure that I have the honor of transmitting to you this invitation, and I respectfully beg that you will transmit it to the membership of the World's Dairy Congress.

That is signed by the executive director. [Applause.]

Toastmaster MUNN. We are highly honored, and it is a great privilege to me to introduce the next speaker. I have known of him for many years and had the pleasure of knowing him personally somewhat. I have observed in him a man who has valiantly struggled, and in part succeeded, in maintaining that necessary equilibrium between human progress on the one side and a constitutional form of government on the other. His notable action in recent days in securing a settlement of the coal strike is only evidence of his long action in this regard. [Applause.]

It is with pleasure that we have such a man as the governor of this great State, having him take part in and helping to advance this great industry in which we are all so deeply interested. He has appointed to his cabinet a man closely identified with the development of the industry in this State and who was formerly president of the producers' association in this locality. [Applause.]

It is with very great pleasure that I present to you Hon. Gifford Pinchot, Governor of the State of Pennsylvania.

(The delegates and guests arose and applauded.)

SELF-GOVERNMENT IN INDUSTRY.

GIFFORD PINCHOT, A. M., Sc. D., LL. D., Governor of Pennsylvania.

Mr. President, friends: I count it a matter of keenest gratification, the keenest personal gratification, that it has fallen to my lot as, for the time being, the executive of the State of Pennsylvania, to express the welcome of our Commonwealth to the men and women who have come to us from other nations. You have been made to feel to-day, I think, how warm that welcome is. [Applause.] I am sure you would not have felt it if the warmth were not in the first place in the hearts of those of my fellow-citizens who have been fortunate enough to take part in that welcome.

I wish it might be possible for me to address you all in the languages which you speak.

(Governor Pinchot then spoke a few sentences in French and German.)

But I can not go the whole round. [Laughter.]

I can only add that in expressing the warmth of the welcome of the State of Pennsylvania, I am sure that I have the right to express also the warmth of the interest and the sympathy and the desire to help of all Americans for all the world, and the feeling of responsibility that we have, as the older brother or the richer brother to do what we can to bring back prosperity around the whole globe. [Applause.]

I shall not take your time to-night to discuss the achievements of the National Dairy Council with which you are already familiar, or of the Interstate Dairy Council, whose peculiar guests you have been to-day. I have long been familiar with its work. I know it has done two things. It has improved the grade of milk produced; it has increased the consumption of milk. Life has been better for farmers because of it; life has been better for all the people of this neighborhood because of it.

The Interstate Dairy Council has been a good citizen and has deserved well of its fellow-citizens throughout its sphere. [Applause.]

Pennsylvania is intensely interested in this whole milk question. To begin with, I took not one member of my cabinet out of the dairy council, but two. [Applause.] Not only Frank Willits, my old friend (at whose side I have worked or tried to work for the farmers of the State and of the United States for so many years), but also Clyde King, the milk arbitrator [applause], one of the most useful citizens of this Commonwealth and of the whole United States. [Applause.] I wish he were with us to-night.

Now I have something particular that I desire to say this evening, and for that reason and because it is a rather delicate subject to discuss, I have written it down. It will take me but a few moments to read it, but I must say precisely what I mean, and unfortunately the stenographer (who was not one of those whom we saw on the stage to-night) who wrote it up, did so in single space and I shall have to put on my glasses in order to read it.

The Philadelphia Dairy Council is a striking example of self-government in industry. The result has been better sanitary conditions on the farms, better milk for the public, a larger per capita consumption of milk, better prices for the farmer, and lower prices to the consumer than those in any other large city in the United States. Self-government in the milk industry which supplies Philadelphia has been fully as good for the public as it has for the industry itself. The industry has looked after the general interest as zealously as it has its own.

Those of us who are not socialists will agree that government should interfere as little as possible with industry and still secure the protection of the safety, health, and morals of the people. No one will deny that where it is necessary government must and will establish contact enough with private business to assure such protection. No one will deny that menaces to public morals, health, and safety supply good reasons for combined action by all the people in their own defense.

The history of government affords ample proof that the extent of interference by government with any industry or profession depends mainly on the attitude and action of the industry itself. Those professions and industries which have regulated themselves to the point of assuring a square deal to the public have had the least interference. Those professions and industries which have disregarded the rights of the public are precisely those where the government has stepped in. Nothing is more certain than that the rights of the public will finally be protected either by the action of each industry or profession, or by the joint action of the people themselves.

Lawyers, architects, engineers, doctors, undertakers, and many other professions have established codes of ethics for the protection both of the profession and of the public, and are forcing their own members to live up to them. We hear no talk of government interference with any of them. Liquor dealers, on the other hand, for years systematically disregarded the most elementary requirements of decency, refused to regulate their industry in the interest of the public, and have reaped the natural reward. [Applause.] Nothing is more certain than that their business (with its agency, the saloon) is on the verge of disappearance, not only from Pennsylvania but from the whole United States.

In the case of the saloon, the evil was so great that the public rightly became convinced that it could be abated only by complete abolition. With most industries the abuse is less violent and the proper remedy far less drastic.

Just at this time the people of the United States are face to face with the problem of deciding what shall be done about extortion in the prices of anthracite coal. They have reached a degree of exasperation which makes it entirely certain that a remedy will be applied. The question is no longer whether there shall be a remedy but what that remedy shall be.

No one seriously denies that the abuses exist. Shall the public step in and remove them with a strong hand, or will the industry clean its own house? One of those two things will happen, and happen soon, just as surely as the sun will rise to-morrow.

The way to prevent governmental interference is to make it unnecessary. Speaking broadly, no profession or industry in this country has ever been subjected to obnoxious governmental interference without having itself to thank. But if an important business or profession fails to deal fairly with the public, the time always comes when the public itself undertakes to assure for the people at large that fair treatment to which they have an inalienable right. Interference follows abuse—always has and always will. There has always been and there will always be less government interference with those businesses which have the good sense to govern themselves.

Will the hard-coal industry voluntarily assume its proper duty of eliminating extortion and treating the people fairly? If it will, the threat of Government interference which has bulked so large in the minds of many of its leaders need keep them awake no longer. If it will not, no power in America can keep the people of this country from asserting their proper rights and compelling the hard-coal industry to live up to standards of decency which the public will set up and enforce. And if the people do so it will be because and only because the industry was not wise enough to set and enforce these standards itself.

I have heard much talk from the leaders of the anthracite operators about their own concern over the rising price of anthracite. The remedy is in their own hands.

The public interest not only permits but requires that every necessary industry shall earn fair profits on its legitimate investment. Without them the public can not be served. But, because the public is willing to pay a fair profit is no reason on earth why it should stand for extortion. The time is at hand in the case of anthracite when it should refuse and will refuse to do so. The question before the anthracite industry is this: Will you be good of your own action, or will you delay until the public forces you to be good?

My friends, I have spoken in a very unmodulated voice because I have spoken into one of these things [radio] before, and I know that if you attempt to drive any point home through a transmitter of this kind it is lost. The lack of emphasis with which I have made my statement does not in the least represent my own state of feeling on the subject. [Applause.]

In closing, let me say that I have been fortunate in meeting old friends, even among the foreign delegates, as I have many old friends in the room among Pennsylvanians and Americans from other States. The whole occasion has been to me a most delightful one, as I am sure it has been to you. And never have I enjoyed in the course of a somewhat long and misspent life [laughter] more delightful amateur theatricals than those we saw this evening.

My best thanks and best wishes to all of you.

(The members arose and applauded.)

Toastmaster Munn. When we first opened our office in Chicago to begin the work of the National Dairy Council, it was my privilege and opportunity to call upon the next speaker for some advice. I received a very warm and welcoming reception and some excellent advice. We have always tried to have the work of the National Dairy Council on a plane so high that the welfare organizations of this country, National and State, would be willing to cooperate with us and welcome us into their field of activities.

One of the first so to do was the next speaker on this program. She has been active for many years in welfare work, I think one of the first to take up the outdoor classes, and from that has advanced to general welfare work, always with judgment and consideration, but with determination which has brought to her the rewards which such effort demand.

It is, indeed, fortunate for us to have with us this evening to address us Mrs. Ira Couch Wood, of the Elizabeth McCormick Memorial Fund, of Chicago, Ill. [Applause.]

THE RELATION OF THE DAIRY INDUSTRY TO CHILD WELFARE.

Mrs. Ira Couch Wood,[a] director, Elizabeth McCormick Memorial Fund, Chicago, Ill.

Mr. Chairman, Mr. President, our foreign delegates, and the members of the International Dairy Congress: I heard some one say something about an anticlimax this morning. You know a governor is really supposed to be the climax of almost anything in this country except when you have a President present, so really I feel you have had your climax. [Laughter.]

I have a suspicion that perhaps your chairman, delightful as he is and kind as he always is and considerate to his friends, may still have had the same feeling as a certain man who had several speakers on his program. As the evening went on first one and then another drifted out. The climax seemed to have been reached and there was still a speaker or two. This poor, harassed chairman saw the people going out, so he finally made the following plea: "Oh, friends, don't go; wait awhile; we have another speaker on the program. He is a good man; he is an ex-officer; he is a soldier; we ought to hear him; just come back and sit down. This man is a soldier; he was in the late war; he went through hell over there for us and we ought to do as much for him here." [Laughter and applause.] I have seen chairmen facing that same situation.

I am here to-night, as your chairman says, in the interests of the children, since I represent a service that is directly concerned with the children of this country. The Elizabeth McCormick Memorial Fund was founded by Mr. and Mrs. Cyrus Hall McCormick. Mr. McCormick, as many of you know, was at the head of the International Harvester Co. for many years. This fund which I represent was founded in memory of Mr. and Mrs. McCormick's only daughter, Elizabeth, a very beautiful and talented child, who died when she was 12 years old. That the spirit of her life might carry on in the lives and happiness and health of other children, this foundation was established in her name, the aim being to improve the condition of child life in the United States.

Your chairman has very kindly spoken of me as one of the pioneers in the movement. I really was something of a pioneer, and I have often thought of myself to a slight extent as a godmother to this present movement in the dairy industry of which we have seen and heard such splendid things to-day. It is very rarely that one lives to gather the harvest from the seed one has himself sown. I am very glad, before I get any grayer and any older than I am, to see some of the accomplishments of that movement concerning which I had something to say in the beginning.

It was only five years ago that down in Columbus, Ohio, your president, Mr. Van Norman, and I sat with a few choice souls there and discussed the possibilities of cooperation between welfare organizations and the dairy industry. It was not a particularly auspicious occasion. It was the time of the influenza epidemic, and there were only half a dozen people who dared brave the microbes and come out to the Dairy Show. We were right in the midst of the great war, which was in its last desperate stages. We were just weighing and measuring children, but we did not know then what a poor showing those children were going to make, and we did not know fully the fact that so many of our men were unfit for service. We had not then realized that the homes and schools of this Nation were not producing a young manhood fit for the business of war; and if we were not fitting them for the business of war, surely we were not doing an efficient piece of work for the much bigger business of producing citizens. [Applause.]

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[a] Mrs. Wood died Dec. 19, 1923.

We sat there and talked of what might happen. Your president had this vision of the cooperation that might come from these organizations, and we talked a little of the possibilities and of the future. Just at that moment our hearts were very much touched by the conditions of the children of Europe, by the tragic spectacle of those starved, diseased, and wounded children who were collecting in all the different points in Europe.

Our purse strings were opened here in America, I am happy to say, very generously, but we little dreamed at that moment that we should find in this country, the land of plenty and wealth, a whole army of children who were suffering for lack of food—the right food—here, where everything seemed to smile and every prospect was pleasing. Yet that is just exactly what we found as we have heard so many times to-day. We had the great army of the physically unfit and the undernourished children to deal with.

My conference at that time with your president was followed, as your chairman has said, by a conference with him and his associates in Chicago, and in just a short five years see what has been accomplished. A great group of trained men and women has arisen, working whole-heartedly for the children of the country, taking health education into the schools—and surely that is where it belongs.

You know, by our law, of which we are so proud, we condemn a child to school much as we condemn a prisoner to jail. He must go when he is 7 and he must stay until he is 14; but we never thought to write into that law that the children should be released at the end of the school period finer, sturdier, physically as well as mentally. That is the thing we must have in mind to-day.

This is the reason that health education, to me, seems so significant. We are bringing it to the children in the schools, the one place where we touch every child. There it can be carried by the teachers who have so much of the modeling and the molding of the future of America in their hands.

It seems to me it has been very evident to-day that we are making progress. We are not having the formal teaching of physiology of which Miss Jean spoke this morning—learning all the bones and muscles in the body and never practicing a health habit. We used to study about 40 pages on the evils of alcohol and a great deal about its effect upon the liver, which the Women's Christian Temperance Union was perfectly sure we should learn in my early days. In place of such stereotyped learning there is now a vitalizing force going through the schools, that means, in the end, the health of the children and the power of the Nation—a distinct contrast to the sort of physiology taught to the boy who, when asked to describe the spinal cord, thought awhile and then said, "The spinal cord is a flexible bone. Your head sits on one end of it and you sit on the other." [Laughter.]

We have lived to see health education popular. It is even becoming fashionable. To use the slang phrase, "Everybody is doing it." Certainly that is a measure of success—in America at least. We are singing, we are playing, we are filming, we are "radio-ing" health. The fact that this message is "registering" must have been evident to you to-night in many ways.

Everybody is in the game now and many unusual factors have been introduced. Even the humble yeast cake has come into its own; the despised goat is now a very fashionable addition to the dairy industry. Doctor McCollum has found a use for the rats and the stupid guinea pigs.

Your president has said that we need a new name to describe what we are doing. We have, as a matter of fact, a whole new health vocabulary. We have to use these new terms rather carefully or we may cause considerable consternation. Take, for instance, the word "nutrition." A little boy who had just been given a physical examination went to his teacher crying bitterly.

"Why, John," she said, "what is the matter?"

"I am never going to that doctor again as long as I live," he wailed.

The teacher was much disturbed. "Why, John," she said, "I have never seen you cry before. Wasn't the doctor kind to you?"

"Kind nothing. Look what he wrote on my card."

The child dramatically cast his card down before the teacher. "Poor nutrition" had become "Poor Nut" through the doctor's special way of abbreviating.

There are a good many ways in which it seems to me your industry is peculiarly fortunate. The scientists are strengthening the value of your product. Without even being asked to do so they are bolstering it up every day. Doctor McCollum and all the rest are adding, day by day, to your capital and to the value of your product. You even please both types of food cranks—those who believe in no cooking and those who believe in cooking everything. Milk fills both needs without any difficulty.

You have made milk stand for more than a white wagon and some rattling bottles. You are making children and parents feel that it is the very source of life itself. I think yours is the only group where welfare work brings a direct financial reward, as it is quite right it should. The rest of us, you know, have a belief that social service has a reward in human values and the consciousness of work well done, but your welfare work furnishes the best medium in the world for selling the thing you have to sell.

I do congratulate the dairy council on having the vision to grasp the fact that this indirect selling method of putting the welfare of the human race first is the soundest way that ever has been devised of advertising what you have to sell. It is much more effective than even a full page in our world's greatest newspaper—which, we are constantly assured, is published in the town I happen to come from. [Laughter.]

But, of course, while you are fortunate in having chosen this dairy industry, it brings with it certain very great responsibilities.

You deal, in fact, with life or death—the greatest things that come to man—since you further his health, which is after all the great essential. Therefore, there can be, of course, no excuse in your business for a commercial trick, for a poor bit of advertising, for anything that looks like profiteering, because you almost hold the source of life in your hands.

There is an old fable that, it seems to me, may well be given deep thought by your industry:

> In the city of Bagdad lived Haykem, the wise one, and many people went to him for counsel, which he gave freely to all, asking nothing in return. There came to him a young man who had spent much but got little. He said, "Tell me, wise one, what shall I do to receive the most for that which I spend?" Haykem answered, "A thing that is bought or sold has no value unless it contains that which can not be bought or sold. Look for the priceless ingredient." "But what is this priceless ingredient?" asked the young man. Spoke then the wise one, "My son, the priceless ingredient of every product in the market place is the honor and the integrity of him who makes it and markets it. Consider his name before you buy."

You have in your hands this priceless ingredient. What will you do with it? You are stewards of this life-giving substance. The world is right in looking to you for an accounting. You here tonight represent the brains, the commercial instinct, the industry, and the wealth of this great organization. How are you going to utilize this force? You have, above all things, the possibility of united action. You have already done much, but you have yet much to do. There are places all over the world where people never see milk, much less taste it. There are places in my own State of Illinois where one can not be sure of a glass of pure milk. Are you going to do your utmost to make certain that every child in the world has milk to drink, and pure milk at that? Are you going to see that every single child knows the value of milk? If you do these things, will you not make a fine accounting of your stewardship?

Will you so discharge your stewardship that every one of us can trust to you our children, our priceless possession and the Nation's greatest guaranty of its future greatness and leadership? Shall we build health efficiently and soundly on the trust that we have that you will guarantee purity in your product?

You are the custodians of a substance that gives life. No king, no emperor ever held such power as you hold through this substance that is yours to sell or to barter.

On your honor and honesty and your vision of what your industry can become, almost a whole world hangs. If you discharge your duty well, what will be your reward? The consciousness of work well done, of a trust and faith kept for the world, of a look of perfect confidence in the clear, confiding eyes of a child, and the knowledge that you have followed the teachings of the Master, who said "Inasmuch as ye have done it unto the least of one of these, my children, ye have done it unto me." [Applause.]

Toastmaster Munn. Recently in England it was my privilege to meet the next speaker. I called at one of the national organizations in England and inquired for the gentleman in charge and was presented to Mr. Langford. I found in him one quite keenly alive to agricultural conditions in England, Scotland, and Wales, one who had guided for a year, as president, the activities and destinies of the National Farmers' Union of England, and was then and still is chairman of the Milk Conference Committee of England and Wales. He is over here attending the World's Dairy Congress as the direct representative of the farmers' organizations of England. We are indeed privileged to have him here, and it is a great pleasure to me to have the opportunity of presenting him to you. Mr. Langford.

(The members and their guests arose and applauded.)

PRODUCTION AND MARKETING OF DAIRY PRODUCTS IN ENGLAND.

E. W. LANGFORD, J. P., past president, and chairman of the milk and dairy produce committee, National Farmers' Union of England and Wales, Hereford, England.

Mr. Chairman, ladies, and gentlemen: I can assure you it affords me very great pleasure to be here. It affords me pleasure on my own account and it affords me very great pleasure that you have done me the honor of asking me, as the only foreigner of the 44 nations here represented, to address this meeting to-night.

I don't know why that distinction has fallen upon me, except, perhaps, it be that we sent from our country a great many men to help found this great Nation. [Applause.] And coming, as I do from that little island, I talk to a great many American citizens here who tell me that their forebears came either from one part of England or another, and a great many indeed came from north of the Tweed, Scotland, and not a few from that principality, that little country known as Wales.

So there is very much in common between England and this great Nation of yours, and we are proud to be here to-night to represent England, Wales, and Scotland as we do at this conference. May I remark that out of all the nations we have the distinction of sending the greater number of delegates to this congress. [Applause.]

As I said before, I come from a very small country, but nevertheless a very great country, but I never quite realized the importance of that country in regard to international trade until I came to this congress. What do I find? Practically every speaker who has spoken up to now has mentioned the name of England more than any other nation—and why is it? It is because we are the greatest customer of every nation in the world for any surplus goods that they have to sell. Indeed, I feel that at this congress every nation is trying to get into the market. It appears to me that every nation is a traveler, knocking at the door of England's markets.

Well, up until now we have imported a very large quantity of the necessities of life. We only produce in our country 44 per cent of the milk and milk products we consume. We, therefore, import from one or many countries 56 per cent of our requirements. In addition to that we spend annually 90,000,000 sterling in lamb, mutton, and wool. We spend no less a sum that 55,000,000 sterling in pigs, bacon, and pork products. We spend millions in money for poultry and eggs.

But, in common with agriculturists all over the world, we are passing through a very great crisis, and I regret that the crisis is no less in other countries than it is with us. I had the pleasure yesterday of listening to one of your Senators speak before the Rotary Club in Washington. The club had asked him to address them upon the question of wheat growing and the condition that the farmers are in in the northwest of your great country. I learned from him that wheat that costs $1.40 a bushel to produce is being sold for export purposes at $1 per bushel; a state of things like that can not go on, and what is happening in America is happening practically all over the world. Every nation that is producing cereals is producing those cereals at a loss, and England, in common with the other nations, is doing that.

We in our country are determined that we will remodel our methods of farming. Mr. Chairman, we are very conservative in our ideas; we move exceedingly slowly, but we move usually upon safe and sure ground. We think that you in these newer countries can probably produce the wheat that we need cheaper than we can. In any case we are going to buy our wheat in the future from our colonies and from America and from other foreign nations. We are going to treat our tillage as an adjunct to animal farming in the future.

You who are farmers know as well as I do that it is impossible to produce a large quantity of stock without having straw for litter and for other purposes. That is the only purpose for which, in the future, we propose to grow cereals. We will let you have that market, and we hope it may be a source of income and profit to those who supply us with our cereals.

We are determined to do, as I think this congress would desire us to do (and as I am sure every nation so far as I can learn is endeavoring to do), and that is to produce larger quantities of milk and milk products than we have produced in the past.

May I say that we are learning much from your country, and I am certain that the delegates who are here with me are drinking in much that we are seeing. We shall attempt to apply it to our own country. This is a great day for Philadelphia; it is a great day in the history of milk production, advertising, and distribution, and I think you will agree with me that we have seen much to-day that carries conviction to our hearts and our consciences, and we shall endeavor when we go to our own sphere of work and operations to put into actuality what we have seen here with regard to the subtle way in which you advertise milk. [Laughter and applause.]

I am not complaining; I think you have learned much of the art of useful and true advertising. You do not appear to be pushing milk, but I notice that it always comes in—in your plays, in your demonstrations. Therefore we will copy you and endeavor to increase the per capita consumption of milk in my country.

It may surprise you to learn that in England our people up to now only consume, per head of the population, one-third of a pint. We are woefully lagging behind you. We perhaps have not paid so much attention to pushing the food value of milk as you appear to have done throughout America, and particularly in Philadelphia; but we are bending our minds to this problem, realizing, as you have realized before us, that in making known the food value of milk we are helping to build up the manhood, and therefore to build up the nation.

England has been alive to the necessity of doing this for some time past, and something like 18 months ago the National Farmers' Union, whom I have the honor of representing here to-night, sent me to Canada and to America to learn something of the methods of milk production, handling, and distribution, and I came over and I spent several days in this city.

I want to pay a tribute to the gentlemen connected with the trade in this city who gave so much time and so much information to me. Mr. Robert Balderston spent days with me, and he was untiring in his efforts to see to it that I got all the information that I needed before I returned to England. I went on and visited very many cities in the States and from here I went to Canada.

When I went back I was able to put into operation a method of selling milk which has made an immense difference to the milk industry in England. I molded a plan very much upon the Philadelphia plan of selling milk, and not only the producers but the distributors of milk all with one accord agreed that the system that we inaugurated has done a great thing for the industry.

Until we brought forward that plan we had a good deal of bickering with the trade as to what the price of milk should be. A farmer would take the platform and decry the trade and indicate that his margin of profit was an outrageous one. The trader, in order to refute what the farmer had said, also took the platform or resorted in writing to the press and saying bitter things about the producer. The public were looking on and could not decide which of the two, if not both, were thieves and robbers, and in consequence they took as little milk into their homes as possible.

We have settled our differences, we believe now in friendly negotiation, and the result is that we are joining our efforts in propaganda work. We have a national council, which is subscribed to by every phase of the industry, and we are making known for the first time the food value of milk.

I was glad to hear your governor say that he did not believe in too much State regulation and legislation. We, in our country, believe in a minimum of legislation and in a maximum of education. [Applause.] We have a great deal of educational work to do. We have dairy institutes. There is a gentleman here as a delegate from England, Doctor Williams, who in a particular part of England is radiating an extraordinary amount of useful information to the farmers. We appreciate that if we are to extend the sale of milk in our country we have got to give the people a pure, a clean, and a wholesome article, and with that end in view we are doing a good deal of educational work with the farmer.

The trade, in turn, is seeking to learn new methods of handling and distributing milk. I am glad to say that the trade side of the industry has a large number of representatives here, in addition to which we have from Scotland and from England a large number of scientists who are applying their skill to the betterment of the industry in our country.

We are determined to eradicate the reacting cow; we are determined to eradicate the low butterfat yielding cow, and we believe that it is our duty to give that essential food to the people as cheaply as possible, and it is up to us to produce that article as cheaply; therefore, we are endeavoring by recording to eradicate the low-milk-yielding cow.

One is glad to be here and see so many nations represented. One is glad to be here to-night to learn that the ladies are putting their heart and their time into the work of making known the food value of milk. I could never quite understand how it was that you got prohibition in this country, but I have no difficulty of making up my mind to-night when I realize the zeal and the energy of the ladies on the side of what is right, and when I realize what an important factor in voting for prohibition they were, I realize that it was an easy job.

I am glad, at any rate, now that they are perfectly free to devote their time to something of a more useful character. [Laughter.] I am perfectly certain that if we in our country can only enlist the ladies to the same extent that you have here, it will go a long way toward extending the milk industry and toward a larger consumption in the homes of the people of our country.

Before I close I should like also to say that the Ministry of Agriculture of our country and the Ministry of Health are cooperating with us with regard to cleaning up, as it were, the mess with regard to milk production and distribution. We are determined that inasmuch as general agriculture is paying so badly, we will turn our attention to the improvement of our methods of milk production.

However, what I am thinking about is this: If all the ladies in every country do as the ladies in this particular part of your country are doing, there won't be enough milk to go around. The last speaker indicated that she at any rate would not be satisfied until every child in every country had a copious supply of milk to take. If that is the case, undoubtedly there will have to be a very great extension of dairy farming, and if that is the case, it may happen (unless we produce very much larger quantities than we do at present in our own little land) that the countries who are looking to us as a good market, may have no milk to send us. Well, that would be a catastrophe and we shall have to meet it.

Before I close may I thank, on behalf of myself and my fellow-delegates, those who have been so benevolent and generous to us up to this moment and I feel that none have been more generous, more kind to us than the people who have organized this great day in this great city of Philadelphia. [Applause.]

Toastmaster Munn. We are going to close this program on time so no one need get uneasy.

The next speaker will take about two minutes. I am informed he is a gentleman from whose lips phrased humor falls like glittering pearls. I call upon Mr. E. J. Cattell, of the Chamber of Commerce of the city of Philadelphia. [Applause.]

Mr. Edward James Cattell. Mr. Chairman, Governor Pinchot, members of this wonderful congress: I am delighted to say just a word of good night and God bless you after your visit to this my native city. I came over with Penn some several hundred years ago, and I hope the good God will let me stay till the last one goes, because I get more in love with life every moment I live. I am going to live to be 100 years old and then renew the lease at double the rent and do my own repairing. [Laughter and applause.]

I am delighted to be here just to say a God bless you and to thank you for this visit to this city with its 408,000 separate homes. When I was young we could look from a point where I am now speaking and only find 50,000 homes within the limits of this city, so that in my conscious life the homes in this one city have grown from 50,000 to 408,000. And yet to-day we are building a new home every 20 minutes and a new baby every 13. [Laughter and applause.]

I am delighted to say that in this old city we carry on our seal the motto "Let brotherly love continue," which means doing automatically and instinctively those kindly acts which the good God dropped from heaven into the hearts of men to make life worth living.

I am delighted to be here to-night to hear these wonderful addresses and to see in this hall that has had so many wonderful social gatherings this effort to put a little of the milk of human kindness into the cream of society. [Laughter and applause.]

I do think that we want, that the whole world wants, to stop crying over spilt milk and get ready to skim the new cream. The most prosperous times the world has ever seen are just ahead of us. I have traveled 80,000 miles over this country of mine the past year. Everywhere I find hope. I have lived 14 years on the other side of the Atlantic in countries represented by the delegates here.

I sat to-night near some dear friends from dear old Ireland and I told them of the happy days I had there. I thought of one thing that happened while I was there. A man was driving me about and I told him to stop if there was anything unusual to be seen. At a certain point he stopped." I said, "What is unusual here?" He said, "A milestone." I said, "What is unusual about that." He said, "You never see two of them together." [Laughter.]

You have a wonderful gathering; there are more than two of you together, and you are doing God's work in God's world. Years ago driving in the South I saw a little darkey digging potatoes. It was a very cold day. I said, "What do you get for digging potatoes?" He replied, "Nothing, but I get hell if I don't dig them." [Laughter.]

That is the spirit of this work so wonderfully described by the lady who spoke here to-night. It is doing those things which seem to bring no compensation in money but which bring that wonderful income from dreamland, that message from the living God that is back of every smile that we coax to a pinched white face, every new smile and new throb of joy we bring to a little child.

Happiness is just like a shadow, my friends. When you run after a shadow it runs away; it is only when you run away that the shadow follows after. And so it is only when you make somebody else happy that God makes you happy. It is only when you lift a burden that God lifts yours. You get by giving, but you have got to give first.

There is no such thing as growing old. You can get older, but you need never get old. If you can't get what you like, like what you've got—which is a good rule, even for married people. [Laughter and applause.]

I am delighted to see so many ladies here. The Lord made man first and woman after, but man has been after woman ever since. I have carried on the wall of my office for 25 years a sign which reads, "If a pretty girl passes and I don't notice her, call for the coroner, I'm dead." [Laughter.]

God bless you as you go out into the night into that wonderful State of New York that I know and love so well. And God bless you and God give to each of you an answer to your prayers when you ask him to send peace to this world which is filled with blood and pain and tears.

We love you; it has done us good to have you here, and when you go home, think that the mother city of America looks to you for big things to show the God in man, to bring a little heaven to this dear old earth. God bless you all. [Applause.]

Toastmaster MUNN. Doctor Van Norman has something to say to you.

President VAN NORMAN. As president of the World's Dairy Congress, I want to say, "Philadelphia, we thank you." No words can make our thanks more heartfelt than that.

(The meeting then adjourned.)

(Thursday evening, at the close of the dinner in Philadelphia, special trains took the delegates to Syracuse, N. Y., where the remaining sessions of the congress were held. This arrangement was made to give the delegates an opportunity to attend the National Dairy Exposition held in that city October 7 to 13.)

SESSION 5. THE USE OF EVAPORATED, CONDENSED, AND DRIED MILK IN THE DIETARY.

Chairman, Dr. MARY S. ROSE, professor of nutrition, Teachers' College, Columbia University.

Secretary, Miss JESSIE M. HOOVER, specialist in milk utilization, Dairy Division, United States Department of Agriculture.

FIRST BAPTIST CHURCH AUDITORIUM,
Syracuse, N. Y., Friday, October 5, 1923—1.30 p. m.

Chairman ROSE. In spite of many difficulties in getting our program under way, it seems possible for us now to open the session devoted to the use of evaporated, condensed, and dried milk in the dietary.

Being interested in nutrition, nothing seems to me of any greater importance than the consideration of the ways in which we can make a food so fundamental as milk available to people under all sorts of circumstances. Surely this discussion of the ways milk which has been preserved can function in nutrition is a very important aspect of the whole question of the world's use of milk.

The first paper we have on our program this afternoon is, " The development of dried milk as a food, " by Dr. R. J. Blackham, formerly in the British medical service in India. Doctor Blackham is not present, and our permanent secretary has not yet come in, so that I do not know whether he will be represented or not. We will place that paper at the end of the program and go on to the next subject " The use of sweetened condensed, evaporated, and powdered milks for feeding infants in the Tropics," by Dr. W. E. Deeks, who is in charge of the medical department of the United Fruit Co. and who has had considerable experience in the feeding of infants in the Tropics. [Applause.]

THE USE OF SWEETENED CONDENSED, EVAPORATED, AND POWDERED MILKS FOR FEEDING INFANTS IN THE TROPICS.

WILLIAM E. DEEKS, M. A., M. D., general manager, medical department, United Fruit Co., New York City.

Some women cease to lactate shortly after their infants are born, while others lactate insufficiently to nourish their babies during the nursing period. This is particularly true in the Tropics where all metabolic activities are lessened. Other methods of feeding the babies must therefore be sought.

Wet nursing has been employed, but it is only an occasional mother who has sufficient milk to nourish her own child and to provide an extra supply for another. Furthermore, the possibility of contracting a constitutional disease from a potential wet nurse discourages one from resorting to this measure unless other adequate sources are not available.

PREPARED INFANT FOODS.

Almost all of the infant foods on the market, of which there are a great many brands, are disproportionately large in carbohydrates and deficient in fats. Some are deficient also in proteins.

The carbohydrates are derived largely from cereals. Many of these brands contain raw or partially cooked starch which infants are unable to utilize. In the Tropics particularly it was found that the few babies which were able to assimilate prepared infant's food were fat but did not have the energy of a normal child. Excess of carbohydrates leads to a train of characteristic symptoms. Such children are fretful and irritable, with dry lusterless hair, and are subject to intestinal disturbances followed by diarrhea. They are prone to eczema, rheumatism, recurring bronchitis, frequent urination, pustular dermatitis, and other skin irritations. In general, it may be said that this class of prepared foods for infant feeding in the Tropics is a failure.

COMPOSITION OF MILK.

Milk is composed of protein, fats, carbohydrates, mineral salts, and vitamins, and each element plays a definite rôle in the nutrition and development of the child.

Protein.—This occurs in the form of casein, lactalbumin, and nitrogen-bearing extractives of unknown composition, but for the purpose of this paper they will all be grouped together. Protein, with the mineral contents of the milk, is necessary for the building up of new and the repair of waste tissue. Animals which grow rapidly produce milk much richer in these elements than those which grow more slowly. This is very well illustrated in Table 1 (Robert Hutchison) in which is shown the amount of protein, ash, lime, and phosphoric acid present in the milk of some of the domestic animals, and the length of time it takes to double their respective weights:

TABLE 1.

	Time in which weight is doubled (days).	100 parts milk contain—			
		Protein.	Ash.	Lime.	Phosphoric acid.
Human	180	1.0	0.2	0.032	0.047
Horse	60	2.0	.4	.124	.131
Calf	47	3.5	.7	.160	.197
Goat	19	4.3	.8	.210	.322
Pig	18	5.9	....	....	....
Sheep	10	6.5	.9	.272	.412
Cat	9½	7.0	1.0	....	....
Dog	8	7.3	1.3	.453	.493
Rabbit	7	10.4	2.4	.891	.996

If protein is taken in excess it is prone to produce digestive disturbances, with diarrhea, and undigested curds appear in the stools. This is aggravated when excessive gastric acidity is present.

Butterfat.—This is another important element in the composition of milk. It is absolutely necessary, not only for the production of heat and energy (muscular and nervous), but also because the fat soluble vitamin A is associated with it. It is interesting to note that the fat contents vary extremely in different animals. In human milk it ranges from 3 to 4 per cent, whereas in the milk of the whale and walrus, whose young live in the cold Arctic waters, the fat content of the milk is from 40 to 43 per cent. The heat value of fat is two and one-quarter times greater than that of the same weight of a pure protein or carbohydrate.

Carbohydrates.—This in milk is in the form of lactose or milk sugar, and it serves the purpose of producing heat and energy.

Mineral salts.—Milk is rich in mineral salts (except iron), particularly salts of potassium and the phosphates of sodium and calcium, which are necessary for the building up of tissue and bone. When taken in excess they apparently do no harm, as the system will assimilate what is necessary and discard the balance.

Vitamins.—Up to the present, four vitamins are known, which have been designated vitamins A, B, C, and D. These are powerfully active substances and essential food factors in the processes of growth and the maintenance of health. They are necessary for the proper functioning of the glandular structures concerned in digestion, and also of all of the ductless glands which play such an important rôle in the life processes. Their exact composition is unknown, but their deficiency in the diet leads to serious health conditions; in fact, it has been said that food without vitamins is dead.

Human milk, like the milk of other animals, varies extremely in composition. The race, class of food, period of lactation, hygienic surroundings, and individual idiosyncrasies are all modifying factors in the nursing mothers. Table 2 (Robert Hutchison) shows the variation in composition in human milk and cow's milk. It will be noted further that the chemical reaction of human milk is alkaline, and that of cow's milk is acid:

TABLE 2.

	Human milk.	Cow's milk.
	Per cent.	*Per cent.*
Water	87 –88	87–88
Protein	1 – 2	3– 4
Fat	3 – 4	3.5– 4.5
Sugar	6 – 7	4– 5
Mineral matter	.1– .2	.7
Reaction	Alkaline.	Acid.

Any successful method for the feeding of infants must have as a basis some form of milk which must approximate in composition human milk. When human milk is not available, other sources of fresh milk are the cow, goat, mare, and burro, but there are objections to the use of the fresh milk of each of these animals in the Tropics. Table 3 (Robert Hutchinson) shows the average composition of their milk, also of human milk.

TABLE 3.

	Protein.	Fat.	Sugar.	Ash.
Human	1.5	3.28	6.50	0.2
Cow	3.3	3.55	4.50	.7
Goat	2.8	3.40	3.80	.8
Mare	1.9	1.00	6.33	.5
Burro (or ass)	1.9	1.40	6.30	.4

It will be noted from this table that the milk of the burro approximates the composition of human milk nearer than the others, but it is deficient in fat. The writer has seen children successfully reared by the use of burro's milk. In one case the infant was born at the seventh month of gestation and was successfully reared by the use of burro's milk. The burro was kept in the yard, and when the infant required feeding the udder of the animal was washed, then sufficient milk was withdrawn and transferred to the feeding bottle. Few families are in a position to resort to this method of feeding, and there is an objectionable feature in the presence of a burro with its young in your yard night and day. The same difficulties are met with in the use of mare's milk. It is also deficient in fat, and, moreover, there is not sufficient of it available to meet the requirements of the many infants born in the Tropics whose mothers are unable to nurse them.

A great many people in the Tropics owe their lives to the use of goat's milk. Goats are hardy, easily fed, and thoroughly domesticated, and in country districts, where pastures are available, a bountiful supply of milk is readily obtained. Few children, however, are able to assimilate it without modification, and in this respect it resembles cow's milk.

There are also many difficulties encountered with the use of fresh cow's milk. The quality of the grass in the Tropics does not supply a good grade of milk, and to make it satisfactory the animals must be specially fed. Cattle food, as a rule, is expensive and difficult to obtain, and the improved quality and quantity of the milk does not reward one adequately to justify the extra expense. Moreover, the people in most of the tropical countries are not yet sufficiently educated to enable them to realize the necessity of cleanliness in milking, nor do they appreciate the need for proper care of the milk, particularly if it has to be transported to any distance. The continual warm climate favors bacterial growth with consequent changes in the milk. Milk is prone to the invasion of three different types of bacteria: (*a*) The acidophilic group, which grows vigorously and rapidly converts lactose into lactic acid with a consequent souring of the milk; (*b*) the second group (the growth of which is not as vigorous as the first, and is inhibited by its presence), which decomposes the proteins, causing putrefaction in milk; and (*c*) the third group, which consists of the pathogenic bacteria causing typhoid, cholera, diphtheria, scarlet fever, dysentery, etc. These are accidental infections which may contaminate milk and thereby transmit them to man.

The pasteurization of milk, by maintaining a temperature of approximately 160° F. for 20 to 30 minutes, destroys the germs of the third group and all but the spores of the first two groups. When milk is boiled it is said to be sterilized, and practically all germs are destroyed by this process. In the Tropics it is better to boil the milk rather than attempt to pasteurize it. Boiled milk is just as digestible as fresh milk, if not more so. Some claim that the protein in boiled milk is more digestible than that in unboiled milk, as it clots more slowly in the stomach under the influence of rennin and the clot is not so firm. The taste of boiled milk is objectionable to some people, but aeration tends to correct this.

In many districts in the Tropics none of these methods are generally practicable. Therefore, the best available source in all districts for the feeding of infants is sweetened condensed, evaporated, and powdered milks.

In the early days of the American occupation of the Canal Zone great difficulties were experienced in finding a suitable food for the feeding of infants, and the only reliable sources were the sweetened condensed and evaporated milks. Those obtainable in the market were analyzed, and the results showed that they fell into three different groups. The sweetened condensed milks were found to contain from 7.66 to 11.71 per cent of protein, from 9.56 to 10.75 per cent of fats, and from 40.80 to 43.68 per cent of sugars in the form of lactose and saccharose. In other words, they were ordinary milks condensed to 35 or 40 per cent of their volume, with the addition of 40 to 44 per cent of saccharose.

The analysis of the second group (the evaporated milks) showed that they were cow's milk of average composition reduced to about 40 per cent of their volume, and contained protein, 9.67 per cent; fats, 10.14 per cent; and lactose, 12.08 per cent.

The third group (also consisting of evaporated milks) showed about the same degree of condensation as the second group, but the fat had first been removed. In consequence this group was useless for the purpose of artificial feeding of infants. An attempt was made, therefore, to utilize sweetened condensed and evaporated milks in the preparation of a formula approximating the composition of human milk.

Any formula, to be satisfactory, must have (1) the approximate composition of human milk; (2) the material must be sterile; and (3) the method of preparation must be simple in character, in order to be practical. Before discussing the formulæ, it should be premised that the digestive organs of the infant at birth are incompletely developed, but are very adaptable to changes in food, provided these changes are gradual. For that reason, during the first week of the infant's life the formula should be very weak, and at intervals its strength can be progressively increased up to a certain limit. As the child grows older its increased requirements are met by increased quantities and not by increased strength in the milk. In fact, human milk slowly deteriorates in food value during the first year, and the increased demands of the infant are met by increased production.

To meet the requirements, the following formula was devised:

TABLE 4.—*Formula "A."*

[Made from sweetened condensed and evaporated milk.]

Age of infant.	Daily amount necessary.	Sweetened condensed milk.	Evaporated milk.	Water or (after fourth month) barley water.	Amount of each feeding.	Interval of feeding	Number of feedings daily.
	Ounces.	*Teaspoonfuls.*	*Teaspoonfuls.*	*Ounces.*	*Ounces.*	*Hours.*	
1 day	1– 4	....	....	1– 4	¼– ½	2–4	4–8
2 days	8	1	3	7½	½– 1	2	6–8
3 days	10	1½	4½	9½	½– 1	2	8–10
4 days	11	2	6	10	1 – 1½	2	10
5 days	13	3	9	11	1 – 1½	2	10
6 days	14	4	12	12	1½	2	8–10
7 days	15	5	15	12	1½– 2	2	8
1 to 4 weeks	15–25	6–10	18–30	12–20	2 – 3½	2	8
		Ounces.	*Ounces.*				
1 to 3 months	25–35	1½–2¼	4½– 6¾	20–27	4 – 5	2½	6–7
3 to 6 months	40–48	2½–3	7½– 9	30	6 – 8	3	6
6 to 12 months	48	3	9	30–36	8 –10	3–4	5–6

It will be noted from this table that the ratio of the sweetened condensed milk to evaporated milk is 1 to 3, and that its dilution is variable according to the age of the infant.

These formulæ have a general composition as follows:

TABLE 5.

Age of infant.	Sweetened condensed milk.	Evaporated milk.	Water.	Protein.	Fats.	Sugar.
2 days	1	3	60	0.47	0.55	1.33
3 days	1	3	50	.56	.65	1.58
4 days	1	3	40	.68	.80	1.93
5 days	1	3	30	.85	1.03	2.51
6 days	1	3	24	1.08	1.26	3.05
1 to 4 weeks	1	3	20	1.26	1.43	3.55
1 to 3 months	1	3	16	1.51	1.76	4.26
3 to 12 months	1	3	12	1.88	2.20	5.33

It will be noted that the preparations after the first week approximate in composition "mother's milk," except that they are deficient in fats. However, fats in the Tropics are not as essential as they are in a colder climate. Moreover, there is a slightly reduced percentage in the sugar content; but as saccharose has much more sweetening power than lactose, this proved ample in quantity. The only elements absent were the vitamins. These were supplied by the use of orange juice. Beginning about the seventh day 10 drops of this were given each morning before the first feeding and the quantity gradually increased so that at the end of the first month a teaspoonful was given daily, and the quantity increased at the rate of a teaspoonful a month, so that at the end of the year the child was getting 1½ ounces daily. If orange juice is not available, the juice of the lemon or lime can be used, but these are not as agreeable to the infant. Other fresh-fruit juices may also be substituted.

It has been found that tomato juice is equally serviceable. Canned tomato juice is also efficacious. Vitamin C is generally destroyed by heat, but the acids present in tomato juice increase its stability so that canned tomato juice can be used if other sources of fresh vitamins are unobtainable.

It was found advisable also to add from one to two teaspoonfuls of limewater to each bottle of milk just before feeding. It serves the double purpose of, first, neutralizing the acidity normally present in cow's milk, and, second, it prevents the milk clots in the child's stomach from becoming too firm. Hence they are more digestible. When constipation was present the limewater was replaced by milk of magnesia in one or two of the feedings.

After the child is 4 months old barley water, in whole or in part, can be gradually substituted for the water in the formula. and at the age of 9 months some oatmeal jelly can be added instead of barley water. Not all children, however, can tolerate oatmeal jelly, as its protein is more stimulating, and liable to cause skin irritation.

This method of feeding proved entirely satisfactory for more than 90 per cent of the infants. It was initiated about 1908, and is at present used in Panama and in all tropical countries where the United Fruit Co. operates, as well as in other localities.

The formula is prepared as follows: The amount of milk necessary for the entire day is made in the morning. Enough boiling water should be added to the measured amount of sweetened condensed milk to thoroughly dissolve it. Then the measured quantity of unsweetened milk is stirred in and sufficient boiling water added to make the desired quantity for the day. To this is added a few grains of salt, and the milk is divided into as many sterile nursing bottles as there are feedings for the day. Each one is then lightly corked with sterile absorbent cotton and placed in a cool place until ready for use. All that is necessary then is to place a bottle in a pan of warm water, leave it there till the desired temperature is reached, add from 1 to 2 teaspoonfuls of limewater, adjust the nipple, and it is ready for the baby.

A few children have an idiosyncrasy for cane sugar, as it is much more fermentable than milk sugar. When this is found to be the case the formula can be made from the evaporated milks, and some other form of sugar added in proper amount. The next table (6), formula "B," shows how to prepare an infant's food from evaporated milk, with the necessary amount of sugar to be added to each day's feeding.

TABLE 6.—*Formula "B."*

[Made from evaporated milk with added sugar.]

Age of infant.	Daily amount necessary.	Evaporated milk.	Water or (after fourth month) barley-water.	Milk sugar, cane sugar, or dextri-maltose.	Amount each feeding.	Interval of feeding.	Number of feedings daily.
	Ounces.	*Ounces.*	*Ounces.*	*Teaspoonfuls.*	*Ounces.*	*Hours.*	
1 day	1- 4	....	4	....	¼- ½	2-4	4- 8
2 days	8	[1] 4	7½	3	½- 1	2	6- 8
3 days	10	[1] 6	9¼	3½	½- 1	2	8-10
4 days	11	1	10	4	1 - 1½	2	10
5 days	13	1½	11½	5	1 - 1½	2	10
6 days	14	2	12	5	1½	2	8-10
7 days	15	2½	12½	5	1½- 2	2	8
1 to 4 weeks	16-25	3- 5	12-20	5- 6	2 - 3½	2½	8
1 to 3 months	25-36	6- 9	18-27	7- 7½	4 - 5	2½	6- 7
3 to 6 months	40-50	10-12½	30	9	6 - 8	3	6
6 to 12 months	50	12½	30-37½	9-12	8 -10	3-4	5-6

[1] Teaspoonfuls.

The added sugar may be milk sugar, cane sugar, or dextri-maltose. Lactose, or milk sugar, has the same fuel value as saccharose, or cane sugar. It is more expensive (about $0.30 per pound) but is not so prone to fermentation. It therefore agrees better with most babies.

Dextri-maltose (according to Chapin and Pisek): "This is a preparation of malt sugar consisting of maltose, 51 per cent; dextrin, 47 per cent; sodium chlorid, 2 per cent. Each ounce has a food value of 110 calories. It is a readily absorbable sugar containing no cellulose, fats, or proteins. It often agrees better than milk or cane sugar, and is especially indicated in infants in whom it is desired to get an increase in weight without causing sugar disturbance."

The method of preparing formula "B" is the same as that for formula "A," with the exception that no unsweetened condensed milk is used. The measured quantity of sugar is dissolved in hot water before adding it to the measured quantity of evaporated milk. Otherwise the method of preparation is the same.

Certain precautions are necessary in the use of evaporated milk. The sweetened condensed milk has sufficient sugar to preserve it, and if protected from insects will keep indefinitely.

Evaporated milk, on the other hand, after the can is opened is subject to decomposition almost as readily as fresh milk. A fresh can should be opened daily and the unused portion devoted to other domestic purposes, unless placed on ice in a suitable container and covered with sterile cotton or gauze. The mother or nurse who is preparing the milk should always taste it after the can is opened to see that no bacterial decomposition has taken place.

Powdered milks are now being used in the Tropics, and they form a very satisfactory means of preparing infant's food. The writer has had some experience with the brand "Klim," and can recommend its use for infant feeding. Following along the same lines of preparation as devised in Tables 4 and 6 (formulæ "A" and "B"), Table 7, formula "C," shows how to prepare the infant's food from powdered milk. Klim has the advantage, in a warm climate, of keeping three to four months, and the manufacturers claim that the vitamins are not destroyed in the process of preparation. However, as some of this milk is prepared in the winter months when the cattle are stable fed, the vitamin content is likely to be low, and the addition of fruit juices should be supplemented as in feeding by the other formulæ.

TABLE 7.—*Formula "C."*

Age of infant.	Daily amount necessary.	Milk powder (Klim).	Cane sugar, milk sugar or dextri-maltose.	Water sufficent to make—	Amount of each feeding.	Interval of feeding.	Number of feedings daily.
	Ounces.	*Tea-spoonfuls.*	*Tea-spoonfuls.*	*Ounces.*	*Ounces.*	*Hours.*	
1 day	1- 4	....	....	1- 4	¼- ½	2-4	4- 8
2 days	6	2	2½	6	½- 1	2	6- 8
3 days	10	4	4	10	½- 1	2	8-10
4 days	11	6	4	11	1- 1½	2	10
5 days	13	8	5	13	1- 1½	2	10
6 days	14	10	5	14	1½	2	8-10
7 days	15	14	5	15	1½- 2	2	8
1 to 4 weeks	15-25	[1] 4- 7	5- 7	15-25	2- 3½	2½	8
1 to 3 months	25-35	[1] 7-10	7-10	25-35	4- 5	2½	6- 7
3 to 6 months	40	[1] 11-14	12-14	40-50	6- 8	3	6
6 to 12 months	50	[1] 14	14	50	8-10	3-4	5- 6

[1] Tablespoonfuls.

NOTE.—
4 level teaspoonfuls (Klim) = 1 level tablespoonful.
2 level tablespoonfuls (Klim) = 1 ounce by measure.
4 level tablespoonfuls (Klim) = 1 ounce by weight.
9 level teaspoonfuls of milk-sugar = 1 ounce by weight.
(In the preparation of all of the above formulæ, an 8-ounce graduate saves time.)

Formula "C" is prepared as follows: The measured quantity of sugar (lactose, saccharose, or dextri-maltose) should be added to the measured quantity of warm water, and after solution the measured quantity of milk powder stirred in and dissolved.

Table 8 shows the composition of these formulæ, and, as can be seen, the protein and sugar contents are about the same as human milk, but they are deficient in butterfats. This, as stated above, is not so necessary in warm climates, as in cold climates when it might be necessary to add fats in the form of fresh cream or cod-liver oil.

TABLE 8.—*Analysis of the formula in Table 7, formula "C," based on analysis of Klim.*

[Butterfat, 28; protein, 26.74; milk sugar, 38; ash, 5.76; water, 1.50.]

Age of infant.	Protein.	Fat.	Sugar.
	Per cent.	*Per cent.*	*Per cent.*
2 days	0.55	0.57	5.7
3 days	.67	.7	6
4 days	.9	.9	6
5 days	1	1	6.2
6 days	1.2	1.2	6.1
7 days	1.57	1.6	6
1 to 4 weeks	1.70–1.89	1.8	6.1
1 to 3 months	1.89	1.8–2	6
3 to 6 months	1.85	2	6
6 to 12 months	1.86	2	6
Human milk	1–2	3–4	6–7

FOOD REQUIREMENTS FROM 10 OR 12 TO 15 MONTHS.

Some children are as advanced at 10 months as others are at 12 months, or even more so, and a supplemental supply of food is indicated, particularly in the form of protein for tissue building. The first meal of the day, therefore, 6.30 a. m., when the digestive powers are vigorous, may consist of part of the yolk of a coddled egg mixed with the crumbs of rusk, zwiebach, toasted crackers, or well-toasted stale bread, and this can be supplemented with milk. The amount of egg can be gradually increased until the whole egg is taken at a meal. The egg is coddled by placing it in a pan of boiling water removed from the fire and left for 8 or 10 minutes, when the contents jelly. The second meal, about 10.30 a. m., should consist of one of the formulae. The third, about 1.30 p. m., should consist of a well-cooked cereal, or stale bread toasted with milk, and milk to drink. This may be alternated with a good vegetable soup thickened with crumbs, as in the morning meal, and supplemented with milk. The fourth meal, about 5.30 p. m., should be the milk formula, and this can be repeated about 9.30 or 10 p. m. Some children do not require the last bottle and will sleep the entire night.

During this period the child should be gradually weaned from the bottle and taught to drink from a cup and eat with a spoon.

The sweet condensed milk in formula "A" should be gradually replaced by the evaporated milk, or the supplemental sugar in formula "B" or "C" should be gradually lessened so that at the end of the fifteenth month the milk used with the meals should be natural and unsweetened.

FROM THE FIFTEENTH TO EIGHTEENTH MONTH.

The 1.30 o'clock meal may consist of scraped beef, minced chicken, or shredded fish, with mealy baked or boiled potato and butter. This may be supplemented by milk or water.

After the eighteenth month a light general diet can be introduced consisting of well-ripened or cooked fruits, plain milk, well-cooked cereals, toasted stale bread and butter, coddled eggs, minced chicken, vegetable or meat soups, underdone meats, shredded fish, mealy potatoes, purée of vegetables, custards, and simple puddings.

The evening meal should always be light, consisting of bread or cereals with milk, and possibly stewed fruit with bread and butter. Cereals made from the whole grains, such as rolled oats, cracked or shredded wheat, corn meal, etc., are to be preferred.

As these methods of infant feeding have proved so successful in the Tropics, there is no reason why they should not prove perfectly satisfactory in more northern latitudes, particularly among the poor of our large cities where fresh cow's milk is expensive and the cheaper grades subject to putrefactive changes.

COSTS.

Sweetened condensed milk.—Retails in New York markets at a rate of 1⅓ cents per ounce in 15-ounce tins.

Evaporated milk.—Retails at three-fourths cent per ounce in 16-ounce tins.

"*Klim.*"—Retails at 70 cents per pound in 1-pound tins. Forty-eight ounces of the strongest preparation of formula "A" costs approximately 11 cents. This is a quart and one-half, or at the rate of about 7 cents per quart. There is no fresh cow's milk in the city that can be obtained for less than 10 cents per quart, and this is third-grade milk, not suitable for the feeding of infants. Further, it has to be modified and kept on ice. Fifty ounces of the strongest preparation of formula "B" costs approximately 12½ cents, or with the added milk sugar, 8 cents per quart. Fifty ounces of the strongest preparation of formula "C" costs approximately, with the added milk sugar, 12 cents per quart.

If some enterprising milk manufacturer would increase the sugar content of milk to 10 per cent by the addition of milk sugar, cane sugar, or dextri-maltose, and then evaporate it down to 40 per cent and put it up in cans of 4, 8, 12, and 16 ounces, it would simplify greatly the problem of infant feeding by these methods. All then that would be necessary to do would be to dilute the preparation with water, according to the age of the child, and there would be practically no loss in the unused milk after the second week from an open can.

The evaporated or condensed milk would then have, when concentrated, approximately 25 per cent of sugar. This diluted five times would give 5 per cent, and diluted four times would give 6¼ per cent, which is about the amount present in human milk.

If the butterfat could be increased to 5 per cent before being evaporated the result should be ideal.

The same could probably be done in the manufacture of powdered milk.

SYMPTOMS THAT WORRY MOTHERS.

Crying.—A child may cry continuously because of hunger, thirst, colic, earache, headache, teething, or pain from the onset of an acute disease such as pleurisy, pneumonia, meningitis, rickets, etc.

Restlessness during sleep.—This may be due to the presence of colic, adenoids, large tonsils, rickets, or a constitutional disease.

Vomiting.—This must not be confused with regurgitation. An infant with an overfilled stomach, if carelessly handled, will reject some of the stomach contents. Vomiting, on the other hand, may be due to decomposed milk, teething, or the onset of some infectious or chronic constitutional disease. In the tropics malaria is common.

Convulsions.—May be due to indigestion, constipation, intestinal parasites, teething, the onset of an infectious disease, rickets, meningitis in some form (cerebral or spinal), etc.

Teething.—In well-nourished children there are four periods when teeth erupt, and give rise to more or less general disturbances during the first two years. They are about the sixth, eighth, twelfth, and eighteenth months. The time is uncertain, and may vary one or two months from the periods named. The disturbances may take the nature of constipation, vomiting, diarrhea, convulsions, vicarious rashes, restlessness, fever, and irritability, particularly at night. The better nourished the child is the less likely are any of them to occur. If the gum over the incoming tooth is swollen and tender it can be relieved by the use of friction over it by means of a dull, hard, clean instrument, and the tooth rubbed through. An aseptic finger nail is convenient and thoroughly satisfactory.

Skin diseases.—Eczema, and other skin irritations are probably due to the lack of a properly balanced diet.

Observe carefully to—

1. Boil the nursing bottles before they are filled.
2. See that the holes in the nipples are not too large, or the infant will nurse too rapidly; or too small, or the infant exhausts itself in the effort of nursing.
3. Keep the nipples in saturated boracic acid solution when not in use.
4. Always taste the mixture before bottling to see that no decomposition has taken place.
5. When the infant cries between feedings, it may be water and not food that it wants.
6. Weigh the baby occasionally. Increase in weight takes place more rapidly the first few weeks than later.
7. When a child is not thriving never forget the possibilities of some constitutional disease, and seek the advice of the doctor.

RECIPES.

Barley water.—One tablespoonful of pearl barley, after being washed, is added to 1 pint of cold water and soaked for 10 or 12 hours; then strained and the water discarded. One quart of cold water is then added and boiled slowly for 2 hours. Water is added from time to time so that the final product consists of 1 pint. It is then seasoned with half a teaspoonful of salt and strained through muslin or a fine sieve.

If Robinson's patent barley is used, Koplik recommends the following method of preparation: A heaped teaspoonful is suspended in a pint of cold water until the lumps have disappeared. The mixture is then placed in a small saucepan over the fire and stirred constantly for 15 or 20 minutes after it begins to boil. Water is then added to make the mixture up to 1 pint.

Oatmeal jelly.—This is made as follows: One cup of rolled oats is soaked in two cups of cold water for 10 or 12 hours, then strained through a fine sieve or muslin. One cup of cold water is now added to the oatmeal water and the mixture is gently boiled for 2 hours, stirring frequently. One-half teaspoonful of salt is now added, and when allowed to cool the product jellies. Two to four teaspoonfuls of this jelly can be added to each bottle after the infant is 9 months old. It is particularly valuable if there is a tendency to constipation.

Chairman Rose. This paper is now open for discussion.

Mr. H. R. Estes (Flint, Mich.). What is the youngest age at which you would recommend feeding orange juice?

Doctor Deeks. We begin when the baby is a week old, giving 5 or 10 drops daily, and increase it gradually so that at the end of the month the baby is given a teaspoonful daily. We increase the amount about a teaspoonful a month until at the end of the year the baby is getting about 1½ ounces daily.

Capt. John Golding (National Institute for Research in Dairying, Reading, England). What are the calorie requirements?

Doctor Deeks. You are asking me something I can not answer specifically. In any case, I do not believe in the generally accepted theory of calorie feeding in people of any age for the reason that a great deal of the food which we consume does not become assimilated as such, but some of it undergoes fermentation or putrefaction in the alimentary tract, and for that reason can not be considered as nutriment. We give the baby a formula approximating the composition of mother's milk, in standard quantities and intervals of feeding, and are guided by the increase in weight of the child.

Dr. G. C. Supplee (director of research, Dry Milk Co., New York). What is the influence of the flavor of evaporated milk and the powdered milk on the appetite of the infant?

Doctor Deeks. None whatever. He takes one just as well as the other.

Dr. A. H. Flickwir (health office, Houston, Tex.). I would like to ask Doctor Deeks if he prefers this evaporated or powdered milk to certified dairy milk. If they could carry on the dairy industry there and deliver the right kind of certified milk to the natives to give to their children, would he still consider evaporated milk preferable to the right kind of cow's milk.

Doctor Deeks. In the Tropics the grass is poor and we do not get rich milk. Owing to the ignorance prevailing among the people in caring for the milk, it is not practical to feed our babies in that way. We have fed hundreds of children in the Canal Zone according to our methods, and when the parents have brought them north on vacation they have carried their condensed milk with them and continued this method of feeding. The children do beautifully and the method saves everybody considerable time and money.

Mr. O. F. Hunziker (Blue Valley Creamery Co., Chicago, Ill.). Have you found any difficulty, Doctor Deeks, in the suitability of milk powder which is not made right?

Doctor **Deeks**. We have had practical experience with only one form of milk powder—that manufactured by the Merrell-Soule Co. Our experience has not been extensive, but it has proven satisfactory. Owing to the success which we have had with the evaporated and condensed-milk method, our doctors are slow about changing to a new method. We do not get fat babies by this method of feeding, but we get strong muscular babies, which we believe is more desirable.

Mr. **Nathan Loewenstein** (Chicago, Ill.). Doctor Deeks, in making this modified milk, isn't there a difference in the way the fat is broken up?

Doctor **Deeks**. We have had no difficulty with the fat content in feeding the baby as we do. Of course, the finer the fat emulsion the more digestible it is.

Doctor **Sears** (Syracuse, N. Y.). One very fine brand of powdered milk is manufactured by a firm in this city, and I know they would be glad to welcome any delegates. Klim is one of our best powdered milk products made here in Syracuse.

I think the point Doctor Deeks made regarding ignorance in handling milk is very well taken. We who have good milk available here frequently recommend powdered milk for that reason. I am very glad to know that the problem of milk is being solved through the evaporating of milk. I hope some of you delegates will get in touch with the Merrell-Soule Co., who manufacture Klim.

Chairman **Rose**. Is there an official interpreter here? It will be necessary to close the discussion now, in order to get on with our program. Unless you ask for it definitely, I shall assume that it is not desirable the questions be interpreted.

The next subject is, "Observation on milk supply under tropical and subtropical conditions," by Dr. C. P. Sherwin, of Fordham University, who has just been making a survey of milk conditions in the Tropics. [Applause.]

OBSERVATIONS ON MILK SUPPLY UNDER TROPICAL AND SUBTROPICAL CONDITIONS.

Carl P. Sherwin, Sc. D., M. D., Dr. P. H., LL. D., professor of chemistry, Fordham University, New York City.

That part of America which stretches from the Rio Grande south through Mexico and Central America and includes the northern countries of South America offers in many ways a most interesting field for the study of milk conditions in relation to the influence of these conditions upon the use of milk in the United States. In these tropical and subtropical areas we find, carried to a much greater degree, those problems which confront us in many sections of North America. As a field for research and study, Mexico, Central America, and northern parts of South America provide a most fertile ground. The population is quite dense in certain sections, with all the problems of supplying milk to an urban population. In others, it is exceedingly sparse, and there are all the problems of getting milk under poor delivery methods or no delivery methods at all. We find here an accentuated condition of poor feed for such cattle as are to be found. We find many sections where there is almost a total absence of cattle. In other sections, we find cattle of such low grade that the milk they provide is at best of an inferior quality. There is, naturally, little or no attempt to safeguard the milk supply by providing for a health and condition standard for cows. In addition to the scanty supply of cow's milk, there may be found in certain sections a supply of goat's milk, and in other sections ass's milk is used to a certain extent. It is an unorganized field so far as milk supply is concerned. In some sections, where tropical vegetation flourishes in the rainy season, one finds a liberal supply of milk during certain months, to be followed by long months when there is practically none.

So far as the adult is concerned, there is every indication of a lack of milk in the daily diet, but our greatest concern is naturally in regard to the problem of the feeding of the growing child and the infant unable to enjoy the advantage of a normal supply of healthy mother's milk.

Naturally, the scanty and inferior supply of fresh milk is augmented by condensed and dried milk, and in all this section one is able to find, therefore, a most interesting field for research as to the influence of dried, condensed, and evaporated milks. Inasmuch as dried, condensed, and evaporated milks are in such wide use in the United States, it was especially interesting to study comparative influences of these products in tropical and subtropical sections where conditions were in every case accentuated.

It is a fact that the infant in Mexico, Central, and northern South America is likely to be nursed for a longer period of time than is the case in the United States, but where a substitute for mother's milk is necessary in the majority of cases sweetened condensed milk is to be found. In fact, sweetened condensed milk seems to be the outstanding milk product widely and generally in use in these countries.

As one compares the use of condensed milk in the feeding of infants and young children between northern Mexico and southern Mexico and Central America, a striking condition presents itself. It is evident that the general condition of the infant and the child, as well as the adult, in the districts farther to the south is better than that to be found in the arid area farther to the north.

Investigating further, one finds that in these rather primitive sections the natural tendency is to partake heavily of fruit wherever fruit is grown. One finds, too, that the liberal use of fruit and fruit juices becomes more and more a part of the diet of the child and the infant as one progresses farther into the regions where vegetation is heaviest. It is most interesting to note the gradually improved condition of the infants and children, as well as grown people, progressively with the added use of fruit and fruit juices.

In this connection, we find an interesting analogy between feeding condensed milk in tropical regions and its use in the United States. I have noticed from time to time criticism of the use of condensed milk for infant feeding on the grounds that its high sugar content leads to complications. On the other hand, there are so many manifest advantages in the use of sweetened milk in certain instances that it is well worth while trying to overcome the drawbacks. It is indicated in certain tests and experiments made in Mexican and

Central American cases that the difficulties which may arise in the use of sweetened condensed milk alone, in certain cases. are often satisfactorily overcome if a liberal quantity of fruit and fruit juices is used with a formula having sweetened condensed milk as its base.

This striking difference in the condition of children in particular can hardly be due to any marked changes or differences in climatic conditions. In the various sections milk seems to be fed in much the same way, though, of course, in different quantities in different sections and in different seasons, but the difference in conditions seems to be largely due to the supplementary diet, and this supplementary diet, which varies with different sections, is largely a difference in the amount of fruit and fruit juices enjoyed. Children in all these areas seem to be permitted to have at any time of day just about any article of food which the adult has and which the child may find to its liking. In the fruit sections, this naturally results in the almost constant eating of one sort of fruit or another, and the influence is apparent. This also supports many of the modern theories regarding the value of fruit and fruit juices, not only because of the " roughage " value but because of the vitamin content.

The value of these fruit juices is not only marked in the case where the infant is fed on prepared milk, particularly condensed milk, but also in the case of the quality of the milk supplied by the nursing mother on whom it seems to have a most notable influence.

Naturally, the object of this congress is to determine in every way possible how to better the results to be obtained from the use of milk and how to increase the use of milk. In this paper, therefore, limited as it must of necessity be, I am trying to limit myself, then, to the influence of fruit and fruit juices when fed in conjunction with canned milk, and particularly sweetened condensed milk.

Sweetened condensed milk has so many natural advantages from the standpoint of sterility, distributing facilities, general distribution, and the easy digestibility of the product that it is naturally advisable to study the influence of the use of fruit and fruit juices fed in conjunction with condensed milk when for one reason or another mother's milk fails and a substitute must be supplied.

It must be borne in mind that in case substitutes are desired for infant feeding the utmost care must be taken in furnishing the food accessories so necessary in this case, and it should also be borne in mind that the simplest way of obtaining these fruit juices of the native plants is through the use of the natural fruit itself and that it is not necessary to resort to many of the patent foods or remedial preparations which are supposed to contain fruit juices. It might also be wise to emphasize the fact that where sweetened condensed milk is used in our own country it should be accompanied from the beginning with fruit or fruit juices, this being without doubt even more important than the scientific exactness with which the formula is prepared.

Chairman Rose. Would you like to discuss this paper of Doctor Sherwin's?

Doctor Deeks. There is just one point to which I would like to draw attention in connection with the reason why the sweet condensed milk is so generally used in the Tropics. Sweet condensed milk will keep indefinitely as long as it is protected from insects. The evaporated milk will decompose, if not kept on ice, soon after the can is opened. If large cans are opened there is considerable waste in the use of evaporated milk unless it is all used at once. We overcome this by purchasing the smallest possible cans of evaporated milk so that one is used every day in the preparation of the milk for the feeding of babies. On the other hand, with the sweet condensed milk, as long as it is protected it will keep more or less indefinitely.

I referred to the use of orange juice. If orange juice is not available you can use any other kind of fresh fruit juice, or tomato juice. Owing to the acid character of tomato juice vitamin C is not entirely destroyed during the process of canning, so that when other sources are not available canned tomato juice is acceptable.

Chairman Rose. If there is no further discussion, we will proceed to the next paper, " Variations of the vitamin A content of cow's milk under different conditions of feeding," by Capt. John Golding, head of the chemical department, National Institute for Research in Dairying, England. [Applause.]

VARIATIONS OF THE VITAMIN A CONTENT OF COW'S MILK UNDER DIFFERENT CONDITIONS OF FEEDING.

Capt. John Golding, D.S.O., F.I.C., head of the chemical department, National Institute for Research in Dairying, Reading, England.

The guaranty of fresh milk as the most suitable food for the young mammal of the same species rests on the provisions of nature. The acceptance of fresh cow's milk as food of special value for human beings has been recognized from time immemorial.

This value is not entirely dependent on the nutrients which milk contains, nor can it be summed up in calories, for there are also present certain physiological principles, among which, as the researches of the last few years have shown, the vitamins play a significant part.

The nature of milk as a complete food insures the presence of all the factors necessary for the growth and well-being of the young animal. Four vitamins have already been defined. Under abnormal conditions of feeding, a variation of these vitamins in the milk of the lactating female might be expected, and this was first recognized by McCollum, Simmonds, and Pitz (1916) in their experiments on rats fed on diets deficient in the vitamins A and B. A considerable amount of confirmation of this variation has been produced from other sources. Drummond, Coward, and Watson (1921) have demonstrated that the chief cause of such variation lies in the diet of the animal.

While the experiments reported in this paper were in progress. the results of the work of Kennedy and Dutcher (1922) were published, from which the conclusion was reached that "the presence of the vitamins A and B in cow's milk is entirely dependent on their occurrence in the ration." Further, they stated that stall-fed cows will produce a milk rich in vitamins provided that a suitable combination of grains and leafy food is given to the cows. Kennedy and

Dutcher also consider the quantity of milk which is adequate to furnish vitamin A or B to a rat to be as high as 10 cubic centimeters a day, and they definitely state that 5 cubic centimeters do not furnish enough of either vitamin to meet the requirements of growing rats. This statement, together with that of Osborne and Mendel, when compared with the results of Hopkins, who obtained growth in rats with 2 cubic centimeters of milk given to each animal daily, might indicate that the milk at Cambridge has sometimes a greater natural richness in vitamin A than the milk which was used in the experiments in America.

Another point which has to be considered in experiments on vitamin A is the ability of the animal to store any excess of this factor in its body tissues. In experiments conducted on pigs (Drummond, Golding, Zilva, and Coward, 1920), a storage of vitamin A in the animal body was demonstrated when this factor was supplied in excess in the diet; and in further experiments (Golding Zilva, Drummond, and Coward, 1922), a sow fed on a deficiency diet proved herself capable of raising a litter of healthy pigs to the weaning stage by drawing upon the reserve of vitamins previously stored in her body when on full diet.

In the autumn of 1921 it was decided to start a series of experiments at the National Institute for Research in Dairying, with a view to ascertaining the effect of winter feeding on the vitamin A content of milk fat and also the effect of administering small supplements of a rich source of that factor, such as cod-liver oil, during the period when the animals are usually receiving indoor rations tending to be deficient in the vitamin.

In this work I was fortunate in having the cooperation of Prof. J. C. Drummond and Miss K. H. Coward, of University College, London; Dr. S. S. Zilva, of the Lister Institute, as well as that of my colleague, Mr. J. Mackintosh.

A joint paper on the results of this work has been published in the Journal of Agricultural Science, 1923.

The experiments were planned with the intention of studying the variations of the vitamin A content in the milk of cows kept under winter conditions, such as prevail in the north of England, viz., stall feeding only, of cows partly stall fed and partly at pasture, i/ viz., south country conditons, and of the same cows fed on pasture in the autumn and spring.

The vitamin A, or the growth promoting factor, was estimated in the butter made from the milk of the experimental cows by observing the influence of daily supplements of known weight on the growth of rats, whose growth had been brought to a standstill by a deficiency of that vitamin.

The amount of butter, in grams, necessary is here termed the "*growth dose*," which is, of course, inversely proportional to the concentration of vitamin in the butter.

It was intended that the group of stall-fed cows should be given a typical winter ration deficient in vitamin A until an examination of the milk fat showed that the concentration of the accessory factor had dropped considerably. The group was then to be subdivided into two lots, one of which was to receive a daily dose of a highly potent cod-liver oil, and the other, as a control, an equivalent dose of inactivated olive oil.

The daily rations of each stall-fed cow consisted of 50 pounds mangolds, 17 pounds seeds hay, and a quantity of concentrates varying from 8 to 15 pounds per day and consisting of maize gluten feed, 4 parts, maize meal, 5 parts, and decorticated ground nut cake, 3 parts. The cows began to feed on this ration on December 3, 1921, and continued till January 21, 1922, when 2½ parts of maize meal were replaced by 2¾ parts crushed wheat, this diet being continued till April 1. The seeds hay was of excellent quality and was made in the good season of 1921. It was composed of Italian rye grass, cocksfoot, and other grasses, with some clover and legumes. The diet of the stall-fed cows, receiving no green food, so affected the vitamin A content of their milk that a daily dose of 1 gram was required per rat to produce growth, thus showing a tenfold reduction in potency since the commencement of the experiment, at which time 0.1 gram only was required.

The reduction of the vitamin A content was accompanied by a marked disappearance of the natural pigment of the butter: Units of pigments December 3, 1921, 1.4; units of pigments January 31, 1922, 0.5.

From March 4 to May 31, cod-liver oil was given to two of the cows in daily doses increasing from 15 grams to 120 grams per cow. The growth dose was determined with each increment, and it finally equaled in its vitamin content the highest value of grass-fed butter. No flavor was observed in the butter consequent on the addition of this quantity of cod-liver oil.

The pigment value, however, continued to decrease from 0.6 to 0.35 during this period of cod liver oil feeding. The weight of milk and the percentage of fat were determined at each milking, but revealed that no obvious effect was produced by the administration of this quantity of cod-liver oil.

The partially grass-fed cows received a basal diet similar to that of the entirely stall-fed animals. During January and February the vitamin A content of their milk fat fell almost as low as that of the stall-fed cows. This observation agrees with that reported by Kennedy and Dutcher, that access to open pasture will not assure a ration rich in vitamins unless the pasture is always fresh and green. Neither dry, parched pastures nor dormant winter pastures can compare with the value of fresh green grass in this respect. As the spring advanced and fresh grass began to grow, the vitamin A content of the butterfat improved and its color attained a higher pigment value than in the autumn.

Since this paper was written, another group of experiments on the same subject has been completed. In this series the milk of individual cows has been examined in preference to the mixed milk of small groups of cows, as was done in the case of the first series referred to above.

The experiments were started on December 5, 1922, and continued till July 10, 1923, during which time three cows were available.

At the start the diet consisted of meadow hay, 17 pounds per cow per day, Yellow Globe mangel 50 pounds, and concentrates 9 pounds. The concentrates were made up of a mixture of maize gluten feed, 1 part, soy bean meal, 1 part, and crushed wheat, 1 part.

The extracted soy bean meal and other constituents of the diet were selected to admit of the addition of oils, the effect of which addenda to the ration on the composition of the butter is also being studied.

Date.	Lily.		Lucy.		Scarlet.	
	Diet.	Growth dosage for rat.	Diet.	Growth dosage.	Diet.	Growth dosage.
		Gram.		*Gram.*		*Gram.*
Dec. 11, 1922	Basal	[1] 1.0				
Dec. 18, 1922	do	.3			Basal	1.0
Jan. 23, 1923	do	.3	Basal	0.3	do	.3
Feb. 19, 1923	do	.3	do	.3	do	1.0
Mar. 5, 1923	Arachis oil supplement.	.3	Arachis oil supplement.	.4	Coconut oil supplement.	.2
Mar. 15, 1923	do	.4	do	.3	do	(?).3
Apr. 9, 1923	Basal(seeds hay)	[1].4	Basal(seeds hay)	1.0	Basal(seeds hay)	(?)1.0
Apr. 30, 1923	Cod-liver oil	.1	Cod-liver oil	.2	Cod-liver oil	.3
May 13, 1923	do	.1	do	.1	do	.1
	Grass	.05	Grass	(?)	Cod-liver oil and grass.	.1

[1] Inactive.

Fall in vitamin activity after the seeds hay period occurred in butter from all cows.

A question mark in front of a value means probable activity on the amount following the question mark.

Growth dosage for last butter from Lucy has not been obtained yet.

As seen from these figures, the vitamin value rose at first on the basal diet alone, without the addition of vitamin-containing constituents, and reached a potency of 0.3 gram per growth dose.

This apparent anomaly led us to examine closely the vitamin values of the component parts of the basal ration, which resulted in the discovery that the 1922 meadow hay used in 1923 was richer in vitamin A than the 1921 seeds hay used in 1922. Some seeds hay harvested in 1922 was obtained and substituted for the meadow hay, with the result that the vitamin content of the butter dropped again to a growth dosage of 1 gram.

This result is of especial interest in view of the work on calcium assimilation published at the University of Wisconsin, by Hart and others, who obtained negative calcium balances with alfalfa hays cured in the windrow with exposure to air and light for four days, but positive calcium balances in earlier experiments with alfalfa hay cured under caps. Our experiments, therefore, give comfirmation to their statement that: "These differences in effect of the two alfalfa hays may be attributed to a difference in the degree of destruction during the curing process of the vitamin assisting calcuim assimilation."

The addition of cod-liver oil to the food of the cows in our 1923 experiments again produced a tenfold increase in the growth-promoting properties of the butter, and although in these experiments as much as one-half pound per day per cow was finally given, no taste was detected in the milk or butter. It is to be noted that a clear good quality oil was used.

The work on the effect produced on the composition of the butter by these additions of oil is not yet completed.

The natural variations in the quantity and quality of the milk yielded make it impossible to express an opinion on this aspect of the work at present.

The results show that winter feeding, as practiced in parts of England, may reduce the value of milk as a source of the growth-producing vitamin A, to one-tenth its summer value, but that this can be restored by feeding a substance rich in vitamin A, such as cod-liver oil.

In conclusion, it is as yet difficult to assess fully the clinical and physiological significance of this vitamin variation which is controlled by the nature of the diet; but it will be seen that it is now a definitely established scientific fact, and consequently I think that it is fairly evident that the producer, aiming at the production of the very best milk, will have to take cognizance of these results.

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Chairman ROSE. Would you like to discuss this paper of Captain Golding's?

Dr. ANTONIO PEÑA CHAVARRIA (Colombia, South America). I would like to know if the vitamin content of the milk of the cow raised in the valley is the same as that of cows raised in the mountains.

Captain GOLDING. I, of course, hate to speak generally. We have experimented with pigs running on the high plains in England where the pasture was very much burned up, and they certainly suffered from vitamin deficiency. I would say the richer, greener grass in the valley might well produce a milk richer in vitamins than the poorer grass of a mountain country.

Dr. A. H. FLICKWIR (Houston, Tex.). I would like to ask Captain Golding what experiments he has made with cottonseed oil, what effect that would have on the vitamin, and if that could not be used in place of the cod-liver oil.

Captain GOLDING. We have not used cottonseed oil. Of course, cottonseed cake is commonly used in feeding cows in England, but all these vegetable oils are very poor in vitamins. We rendered olive oil inactive in the first year of our experiment. Because of the bubbling air in it, the quantity of vitamins contained in the olive oil is very small. In our second year we experimented with arachnes oil and coconut oil. There was no indication of vitamins being supplied in the butter of those cows.

Chairman ROSE. Are there any other questions? If not, we will thank Captain Golding for his paper and go on to the next. Dr. Cornelia Kennedy will not be present to read her paper, so we will pass that for the present and substitute for it the subject, "The use of milk in bread," which will be presented by Mr. R. M. Allen, director of the research products department of the Ward Baking Co. [Applause.]

THE USE OF MILK IN BREAD.

R. M. ALLEN, director, research products department, Ward Baking Co., New York City.

Every worker in the field of the "newer knowledge of nutrition" has emphasized the high food value of a combination of whole wheat and whole milk, and the job before the baking and dairy industries is to put whole wheat and whole milk into a palatable loaf of bread. You are interested in the milk. The loaf of bread affords an immediately available and a very practical, palatable, and economic means for the distribution of more milk to the consuming public. The palatability of evaporated, dried, and condensed milks has been a factor for consideration in planning wider sales. Cookery is the best outlet for these products. The custard is eaten now and then, but bread is eaten three times a day by young and old, and the addition of the proper amount of milk solids along with not only the flour but the mineral salt and vitamin B constituents of the wheat, contributes a daily needed and a dependable food balance to the diet.

The preservation of dried milk is not so much a problem between the creamery and the wholesale user as it is when the dried milk is put upon the shelves of the grocer and the druggist. Bread is consumed within from 24 to 36 hours, and the retail problem of the dried whole milks is wiped out through the sale of milk breads.

Many, in fact most, of those engaged in the dairy industry or who are interested in it from a scientific or governmental standpoint have looked upon the movement for more milk in bread as an ultimate outlet for skimmed milk. The consumption of butter is reported to have increased in the United States, since 1919, about 40 per cent, and the more of milk that is used for butter the larger grows the bulk of milk solids not fat. The skimmed milk solids furnish a splendid protein balance for the flour, and the salts of the milk tend to balance the salts of the wheat, just as the phosphates and iron of the wheat tend to balance the salts of the milk. But it must not be forgotten that vitamin A, the most of which is removed with the butterfat, is an important requisite in the diet of both young and old. So that, if the butter is not put into the bread it must be put onto the bread. And if it is put into the bread the child has a better opportunity to get the daily needs of a balanced diet. But ordinary bread is still deficient, even though it contains sufficient butterfat, for it is lacking in balanced proteins, mineral salts, and other vitamins.

Skimmed milk furnishes a cheap source of protein of splendid quality—probably the best of all proteins. The best outlets will be found in cookery. This high-class protein, with its valuable milk sugars and salts, stands in a very unpopular light with the consuming public, first, because it is labeled with the word "skimmed" and, second, because the public have constantly been imposed upon through the sale of partially skimmed milk as whole milk or as a whole-milk product. Porterhouse steak is in the same way a skimmed or separated product, yet we pay the price for this choice protein because it is palatable and we know just exactly what we are getting.

Again, skimmed milk has not come into universal consumption because the sources of protein have been more abundant than the sources of the fat-soluble A vitamin contained in the butterfat. Moreover, milk is one of the natural foods which does not need to be separated in order to make it palatable, as do meats, vegetables, and cereals. The consuming public universally want milk as nature makes it, and if separated the consumer prefers the cream and the butter.

But milk spoils and the butterfat keeps better when separated from the other milk solids and so we have the skimmed milk. To those interested in the conservation of this valuable food and the creation of a popular demand for it, four things are recommended: (*a*) better care of the milk and the skimmed milk so as to assure purity and good flavor, (*b*) a campaign to show the food industries and private consumers how to use skimmed milk in the preparation of palatable food products and tasty dishes, (*c*) education of the consumer to know the exact food value of skimmed milk, (*d*) education of the consumer to realize the necessity for combining the skimmed milk product with butter, in order to get the diet-balancing food elements in the butterfat. In this way the time should soon come when consumers will go to the store and purchase a pound of milk protein, just as they purchase a pound of meat. Skimmed milk powder is, to-day, at the wholesale price of 15 cents per pound, one of the cheapest and best sources of protein for human consumption.

But there is need to have the basic foods, that are well adapted, so prepared as to furnish a diet balance to the daily food. For this purpose the loaf of bread is ideal. Whole milk balances the constituents of the whole wheat, or its separated equivalents, and gets an increased food efficiency out of the carbohydrate, protein and mineral salts in the wheat.

The research staffs of the Ward Baking Co. have built up a white loaf of bread out of whole-milk solids, an extract from the germ and bran of the whole wheat and soluble calcium salts, which is producing normal growth in test animals and reproduction, already into the eighth generation. When fed to children with no other change in the diet than this bread, the result in increased weight and height is pronounced. The congress has invited us to give you the results of our feeding tests with such a loaf. The loaf is the result of years of previous research, both in baking and nutrition. It is an outstanding instance of practical benefit to the consuming public through the application of science to industry. Behind every such result there is an individual who has the vision and the courage to see and to back the necessary research. Many of our industrial leaders, figuratively speaking, are but cutting existing timber without reforestation. Others devote part of the earnings to the planting of new trees. Mr. George S. Ward, president of the company, has given this loaf and the research connected with it most generous backing. Credit is also due Dr. Charles Hoffman, chief, and Messrs. N. M. Cregor, H. D. Grigsby, James E. Mastin, assistant chief, and their associates of the Ward laboratories. Independent check feeding tests and studies have been made by Dr. Worth Hale, of Boston; Dr. H. A. Kohman, of the Mellon Institute of Industrial Research, of Pittsburgh; and by Dr. C. B. Morison, of the American Institute of Baking, in Chicago.

Members of our research staff have consulted with the public-health and food-control services of the Federal Government, and the facts presented here have been submitted to the review of several of the outstanding leaders in the field of nutrition.

Before taking up the loaf, let us sketch for a moment the background showing the need for such additions to the American diet and the responsibility on those engaged in the production and distribution of foods.

Dr. Emmett Holt states in his recent book, "Food, Health and Growth," that "food nutrition is probably the most pressing world problem." The researches in food nutrition during the past 25 years, and particularly during the last 10 years, have taught us facts which if applied can build a race of stronger men and women. We know better how to feed the mother and the child, the boy and the girl, the man and the woman, according to the needs of their age and their work, and we know more about the protective essentials that are necessary in all diets.

The American farms produce an abundance of proper food, but there is an intricate system of preparation, milling, separation, canning, churning, cooking, storage and handling between the farm and the city home. Too much of the vitamin and mineral salt content of the food gets lost on the way, or the food gets separated into so many parts that it requires considerable care and thought for the consumer to recombine it into a balanced diet. During the last 15 years, the cereal, meat, vegetable and fruit foods have been subjected to well-checked feeding tests to determine just what the food contributes to normal growth and health, as well as its diet deficiencies.

Fruits and vegetables are important sources of needed vitamins and mineral salts. Every housewife and cook, as well as every one dealing with fruits and vegetables, needs to know the meaning of "water-soluble." This phrase is used with certain of the vitamins. "Water-soluble B" and "water-soluble C" mean that these vitamins are soluble in and are extracted with water. Some of the mineral salts and proteins are also "water-soluble." And, so, if we have been milling away from the flour too much of the nourishment for blood and bone, we have also been pouring from the vegetables too much of these valuable and "water-soluble" food substances into the kitchen sink. The liquor from the can of peas or beans containing these solubles is poured off and the product further washed before it is prepared for the table. Or if the fresh vegetable is cooked in the kitchen, a part or all of the water used in the cooking is poured away before it is seasoned and put in the vegetable dish.

In butter making, most of the skimmed milk and practically all of the buttermilk with their valuable proteins, mineral salts and vitamins are lost to human nutrition; in cheese making, a large part of these solubles passes away in the whey. Food separations and refinings have followed needs in food preservation, demands in the public taste, and the former teachings of food experts that the calorie or energy content of the product indicated the true value of the food. Changes will be necessary so as to pass the food supply through the existing system of manufacture and distribution with more protection to the vitamin and mineral-salt content. Here comes the duty of everyone in the food industry, the compelling duty of those who determine what goes into the composition, the labeling and advertising of the Nation's food.

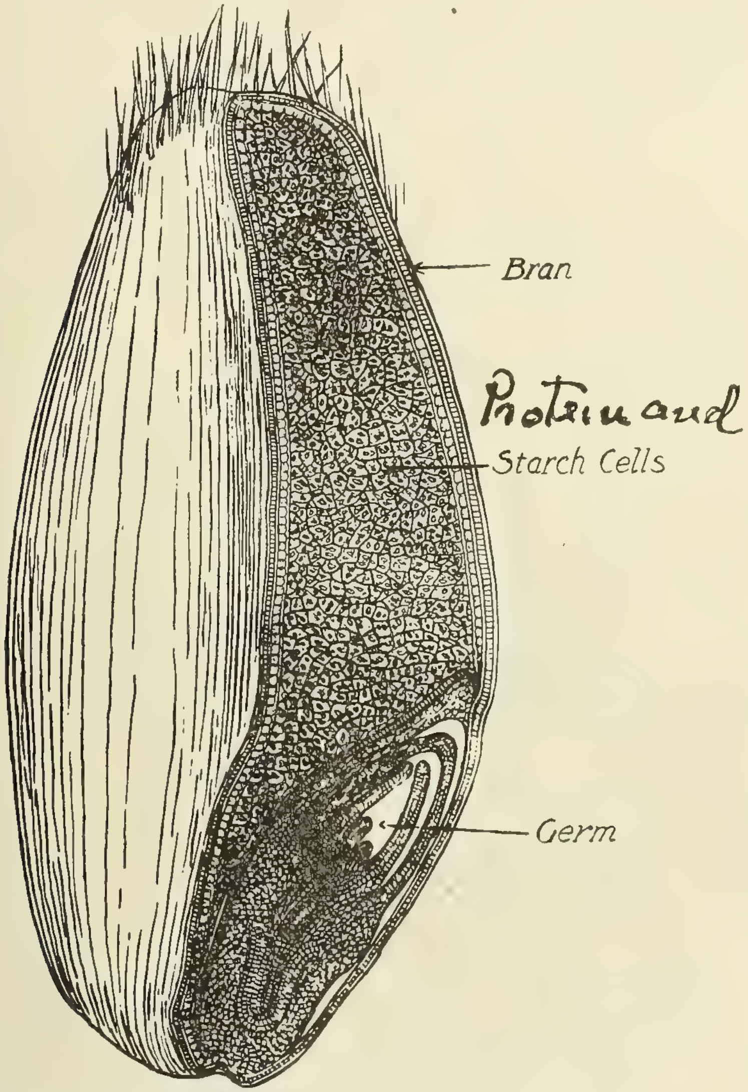
In every feeding test, wherever conducted, it has been demonstrated, and the workers agree, that the combination of the food essentials in whole wheat and whole milk produces the most perfect single food known.

This outstanding fact, demonstrated everywhere in every feeding test, binds the dairy, milling and baking industries into a great common interest with an opportunity to perform a service to the present and to the coming generations, from which benefits that can not be overstated will result.

A controversy has been going on about the food value of white bread versus whole-wheat bread. The miller has separated the bran and germ, which is darker, easily subject to spoilage and has less leavening value, but which is the depository in the grain of valuable proteins, nutrient salts, and the water-soluble vitamin B from the white portions of the berry. These whiter portions contain protein and carbohydrate material of high and very useful food value, and this white bread has been consumed with meat, milk, eggs, fruits, and vegetables to form an adequate and satisfying diet. But where the diet has been limited or where the consumers have not known just what to combine with bread, or just how to combine out of the general food supply an adequate diet, the need for the food substances contained in the bran and germ of the wheat has shown up and dietitians have properly recommended the consumption of bread made from the whole grain. The people have been slow to eat whole-wheat bread. Another step, another process in addition to milling, was needed in order to get the valuable salts, protein material, and the vitamin B into the bread of everyday popular consumption. It was an extraction problem rather than a milling problem.

Turning again to the food value of wheat and milk, we find that whole wheat is very rich in phosphate, but very low in lime. It is rich in vitamin B; low in vitamin A. To get the best results from the phosphates there must be an adequate lime balance. Whole wheat is deficient in lime and in sodium and chlorine, or sodium chloride, ordinary table salt. Whole wheat still needs, from the mineral-salt standpoint, additional amounts of lime and table salt in order to put its other valuable mineral salts into a balanced form for proper nutrition. So, we have white flour with its cheap and valuable proteins and starches, whole wheat with its valuable iron, phosphates, and other salts and yet needing to be balanced with calcium. With these we start out to find what are the other food needs and how best to supply these needs.

We turn to proteins. The wheat germ contains a different kind of protein from that in the white flour, and milk contains still another form of protein than that contained in the flour and wheat germ. When all of these are put together they form a better combination and secure better results than when each is taken alone. In addition to the high potassium phosphate, for example, contained in the wheat germ and bran, we have another substance in the germ, namely, a large amount of vitamin B. This is the vitamin contained in yeast.



LONGITUDINAL SECTION THROUGH A GRAIN OF WHEAT
MAGNIFIED ABOUT 20 DIAMETERS

FIG. 1.—The popular breads made by the bakery and in the home are made from the inside of the wheat berry. The white flour spoils less easily, is more palatable, and makes a lighter and better risen loaf. The bran and germ and the lower grade of flour, known as the "red dog," are richer in mineral salts than the white flour and contain practically all of the vitamin B contained in the wheat berry. Whole wheat bread is one way to get the valuable salts and the vitamin B into the human diet. Another way is to extract them and add them back to the white flour.

On the other hand, milk, while rather stable in the important vitamin A, associated with the butterfat in the milk, varies in the amount and strength of the vitamin B contained.

Now, having found the particular mineral salt, soluble protein, and vitamin B value of the wheat and the bran, the next problem is to get it out into a palatable form for human nutrition. The simplest way is to make a whole-wheat loaf with milk and add table salt and calcium salts. This combination makes a very nutritious loaf of bread. But consumers do not like to eat this loaf of bread every day. Furthermore, the salts and vitamins locked up in the germ and bran are not so readily available when they pass into the digestive operations of the human system.

Flavor is an all-important factor with the food, and close consideration must be given to it, whether it be in the kitchen of the home or in the larger kitchen, the food factory. Flavor and economy must be considered and answered by those who undertake to pass the vitamins, nutrient salts, balanced proteins, and other needs of a complete diet on to the consuming public.

Just what can be done by combining whole milk and whole wheat into a palatable white loaf and its high feeding value is shown in this loaf of bread, which in the feeding data is referred to as "Vitovim."

This loaf of bread is composed of:

(*a*) Strong patent flour to give a well-leavened and palatable loaf.

(*b*) An extract rich in vitamin B, soluble proteins, and mineral salts derived from wheat germ and a small admixture of bran.

(*c*) Whole milk as the only liquid ingredient of the dough, plus added whole-milk solids, including the vitamin A and milk salts.

(*d*) Soluble calcium salts.

(*e*) The usual leavening ingredients, including yeast, salt, shortening, and yeast food. The shortening is selected beef oleo oil, selected in preference to lard for its additional vitamin A.

The nutritional facts established for the loaf are:

The loaf contains proteins of superior food value for growth and strength.

Liberal amounts of vitamins A and B.

A well-balanced variety of body-building mineral nutrients for bones and teeth.

It is rich in the food elements needed by the expectant and nursing mother and growing child.

It supplies abundant energy and builds resistance for young and old at low cost.

Measured by the elements necessary in the food for everybody, this loaf is one of the most perfect single foods ever produced.

The questions presented and which the research staffs of the Ward Baking Co. were called upon to answer were:

(*a*) To what extent could the salts, vitamin, proteins, and other food valuables contained in the germ and bran be separated away from the crude fiber, and how much of the food value contained in the whole wheat would be separated into the extract? What potency would be left in the extract? Would it have the same, a lesser, or a greater potency than whole wheat?

(*b*) How much of this extract would it be necessary to add to a white loaf to make it contain as much or more of the nutrient salts, vitamin B, and soluble proteins contained in the whole wheat?

(*c*) Since even whole wheat is an unbalanced food, what besides the extract could be added to make up a nutritional balance?

(*d*) What were the baking problems involved and how could they be overcome?

The analyses of both white bread made according to the average formula and whole-wheat bread show a deficiency in lime, and whatever else is added to the loaf there must be a proper balance between the phosphates and magnesia and the lime in order to secure normal growth and reproduction. Whole-wheat bread is a good food source of iron, and it is necessary that this be taken care of from organic sources in building up the loaf. An analysis of the new loaf in comparison with good white bread and 100 per cent whole-wheat bread is as follows:

GRAMS PER POUND OF BREAD.

[28.3 grams =1 ounce.]

	Vitovim bread.	Average good white bread.	100 per cent whole-wheat bread.
	Grams.	*Grams.*	*Grams.*
Moisture	172.1	172.1	172.1
Starch	199.3	213.4	187.4
Protein (N×5.7)	40.5	33.7	39.1
Total fat	16.3	10.4	17.2
Butterfat	8.2	1.3	2.0
Ash	9.6	6.5	11.0
Sugar	15.0	16.6	17.4
Lactose	10.2	1.6	2.0
Fiber	.4	.3	9.0

GRAMS MINERAL MATTER PER POUND OF BREAD.

	Grams.	*Grams.*	*Grams.*
Chlorine (Cl)	2.90	3.08	3.04
Phosphates (P_2O_5)	2.37	.86	3.13
Potash (K_2O)	1.54	.50	1.54
Sodium (Na)	1.81	1.77	1.95
Sulphates (SO_3)	1.13	.45	.95
Magnesia (MgO)	23	.20	.77
Lime (CaO)	1.76	.15	.31
Silica (SiO_2)	.050	.059	.045
Iron (Fe_2O_3)	.021	.010	.024
Manganese (MnO_2)	Trace.	....	Trace.
Bromine (Br)	Trace.	Trace.	Trace.

ANALYSES IN DETAIL.

	Per cent.	*Per cent.*	*Per cent.*
Moisture	38.00	38.00	38.00
Starch	43.98	47.10	41.36
Protein (N×5.7)	8.94	7.44	8.52
Total fat	3.60	2.29	3.78
Butterfat	1.80	.28	.45
Ash	2.11	1.43	2.42
Lactose	2.26	.35	.44
Total sugar	3.28	3.67	3.84
Crude fiber	.09	.07	1.98

MINERAL CONTENT OF BREADS.

	Per cent.	*Per cent.*	*Per cent.*
Chlorine (Cl)	0.64	0.68	0.67
Phosphates (P_2O_5)	.50	.19	.69
Potash (K_2O)	.34	.11	.34
Sodium (Na)	.40	.39	.43
Sulphates (SO_3)	.25	.10	.21
Magnesia (MgO)	.05	.045	.17
Lime (CaO)	.39	.032	.068
Silica (SiO_2)	.011	.013	.010
Iron (Fe_2O_3)	.0045	.0022	.0052
Manganese (MnO_2)	Trace.	....	Trace.
Bromine (Br)	Trace.	Trace.	Trace.

The difficulties presented and the method of handling can be illustrated by a few examples. After the extract was produced, analysis told the amount of protein, maltose, dextrins, and salts contained, but there was no knowledge and nothing upon which to base knowledge as to whether the extract contained the vitamin B so potent in the whole wheat and particularly in the germ, and so the first step was to determine from diets deficient in vitamin B with test animals just how much of this vitamin was contained in this extract and how much extract it would be necessary to add to make the loaf complete in vitamin B. After this was determined from material produced in the laboratory, the next step was the production on a large scale of a uniformly sound product containing a standardized amount of proteins, salts, and vitamin, and the further question whether the extract coming out of the commercial process would contain in potent and standardized amount the food accessories sought in the whole wheat.

With the loaf standardized in vitamin B content, the building of it up further into a balanced ration so as to contain adequate proteins, salts, and an adequate amount of vitamin A as well as vitamin B was undertaken. Here, the baking problem as well as the fermentation and leavening of the dough presented their difficulties. For example, when it is found that whole milk and whole wheat produce a nutritional balance, large amounts of the whole milk can be combined with the whole wheat for animal-feeding tests. But when the problem of baking the mixture into a well-leavened and palatable loaf of bread is presented it becomes necessary to find out just how much of the whole-milk solids are needed to produce this balance and how much can be put into the loaf. Feeding experiments were conducted with the wheat germ extract and varying quantities of milk. Finally, it was found that enough whole-milk solids could be put in the loaf to furnish an adequate protein balance with the proteins of the wheat and adequate amounts of vitamin A, but not enough to furnish a sufficient amount of lime salts needed to balance the phosphates and magnesium salts in the wheat, and so it was necessary to turn to another source of calcium salts and to find the form of the salts and the amount which, while producing a nutritional balance, would not have a detrimental effect upon the fermentation.

Chemistry can not yet determine the presence in measured amounts of the so-called vitamins. Feeding tests are the only dependable present methods to measure the value of foods in these directions. On the other hand, the feeding test shows what the food will do in animal nutrition. The feeding tests conducted with the loaves of bread leading up to the Vitovim loaf and feeding tests of popular and widely sold breads, selected from the markets and fed for comparative purposes, were carried on independently in three laboratories. The same technique was employed, the starting weight of the animals was the same, or approximately the same, and the same methods for recording and expressing the results were followed, but the work in each laboratory was kept separate and independent from the other laboratories, and none of them sought to know what the others were doing until a feeding test had been finished and reported. During the development of the loaf, loaves

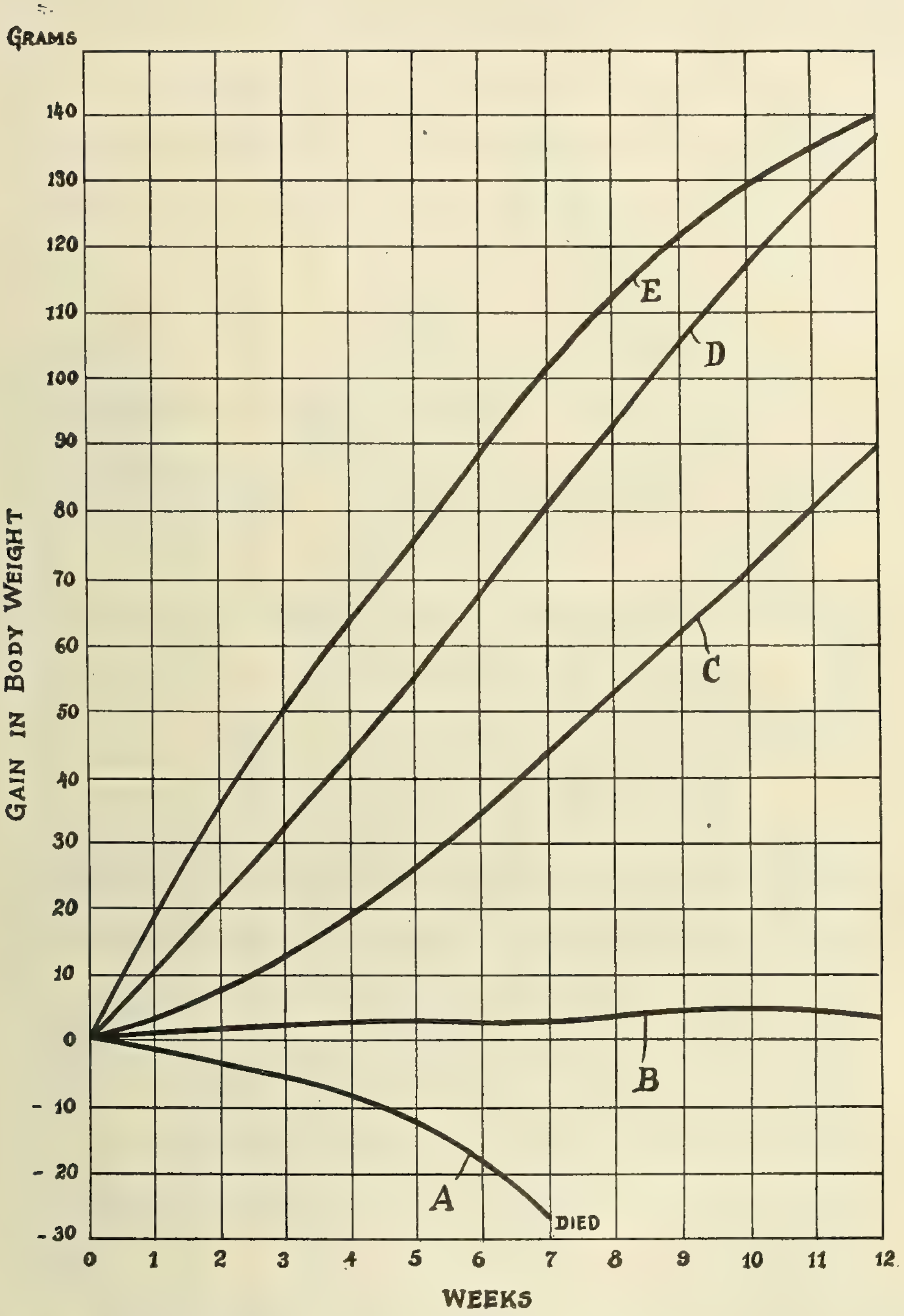


FIG. 2.—This figure shows the growth curves of animals started at about 4 weeks of age and at an average weight of 50 grams. A was fed on a popular white market bread. B was fed on a bread made according to the usual formula of the bakeshop, with the addition of the wheat germ extract. C was fed on a bread made with the additions of the wheat germ extract and whole milk instead of water. D was fed on a bread made with the wheat germ extract, 10 per cent of whole milk solids, based on the weight of the flour, and 0.5 per cent of calcium salts. The space between C and D was found to be a combined fat-soluble A, protein and calcium deficiency.

containing different combinations of ingredients were made at the Ward laboratories and shipped to the other two laboratories, but since the Vitovim loaf has been put upon the market each laboratory carries on its tests with loaves purchased in the open market.

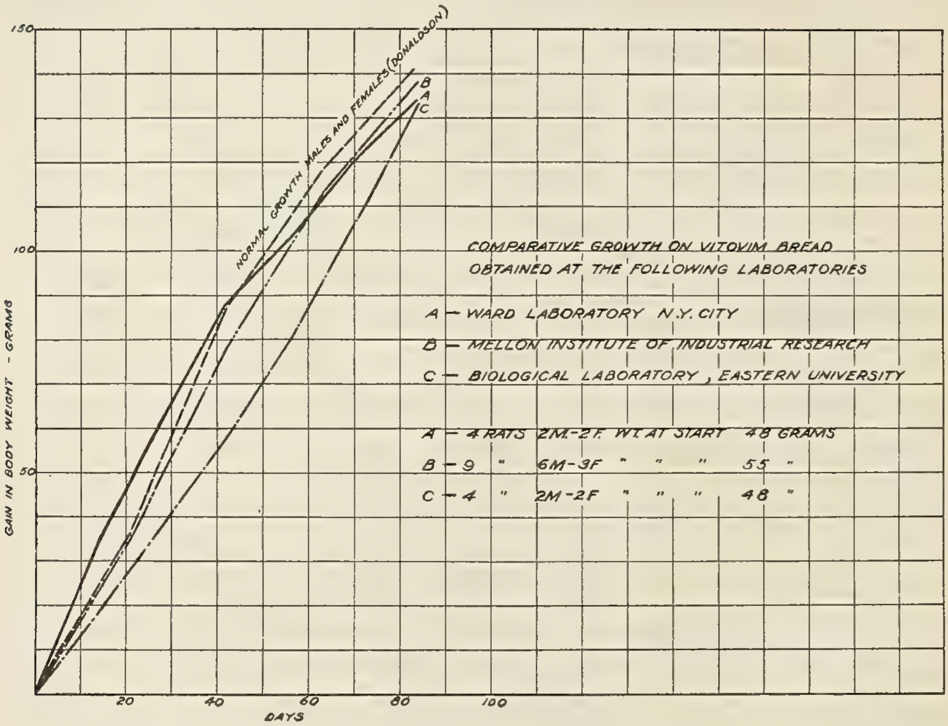


FIG. 3.—Showing agreement of results obtained at three laboratories.

As a normal diet, one that is capable of producing good growth and normal reproduction, the one used by the Bussey Institute for breeding rats was adopted. It is called the basal diet, and the growth curves will refer to it as such. For rats the basal diet was compounded as follows:

	Parts.
Rolled oats	40
Hominy	24
Meat scrap ground	16
Dried whole milk	8
Table salt	1

Basal mouse diet:

	Parts.
Rolled oats	9
Sunflower seed	3
Hemp seed	3
Dried whole milk	1

The Ward laboratory carried on another series of feeding tests using Sherman's normal diet which was found excellent for growth and reproduction. It is made up as follows:

	Parts.
Whole wheat flour	61.5
Dry whole milk	31.5
Table salt	1.5

This diet was fed in comparison with popular loaves selected from the market, and three loaves containing varying proportions of the wheat germ extract, whole-milk powder, fresh milk, condensed milk, and added mineral salts.

Undoubtedly the most powerful compilation of fact in favor of such a loaf is the number of animals in all of the three experiments that grew and lived when fed on these new loaves, in comparison with the number of animals that were stunted, declined in weight, sickened, and died when fed exclusively on three of the most popular white breads from the market, on one so-called vitamin bread and on water-made whole-wheat bread.

These life and death results as shown in the feeding test from one of the laboratories for the individual breads are as follows:

Diet.	Number of animals started.	Deaths to date.
Basal	6 (3 males, 3 females)	None.
Vitovim loaves	18 (9 males, 9 females	Do.
Whole-wheat loaf made partially with milk	6 (3 males, 3 females)	1 female.
Loaf containing one-half whole wheat, one-half patent flour, some milk.	do	2 males, 2 females.
A water-made whole-wheat bread	5 (3 males, 2 females)	3 males, 2 females.
A "vitamin bread" made partly from whole wheat	6 (3 males, 3 females)	Do.
A popular market white bread made partly with milk	do	Do.
A popular market white bread reported to have been made with considerable milk.	do	2 males, 2 females.

All of the laboratories are giving special attention to reproduction. The experiments have been conducted with three pairs of animals for each bread in each laboratory. There has been reproduction among the mice fed on the Vitovim breads now into the eighth generation, and reproduction among the rats into the fifth generation, with no other diet than the Vitovim bread and water. There has been no reproduction with any of the other breads, including in this the whole-wheat breads.

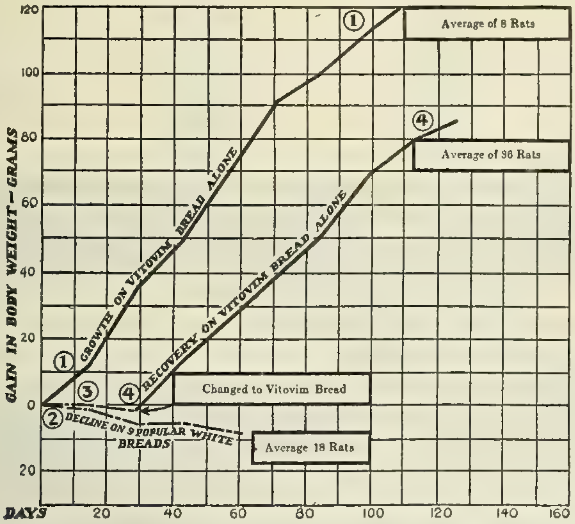


FIG. 4.—This chart shows the growth on Vitovim bread alone, the average decline of similar animals on nine popular white breads, and, following this decline, their rapid recovery after their diet had been changed to one of Vitovim bread and water exclusively.

The ranks of mice and rats on breads other than the Vitovim loaves and a whole-wheat bread partially made with milk were eventually so depleted by death and sickness that it seemed useless to carry the experiments further, and at a conference it was decided to change the diet of these animals to the new bread. The pronounced recovery is shown on the charted growth curves of the animals, Figures 4 and 5.

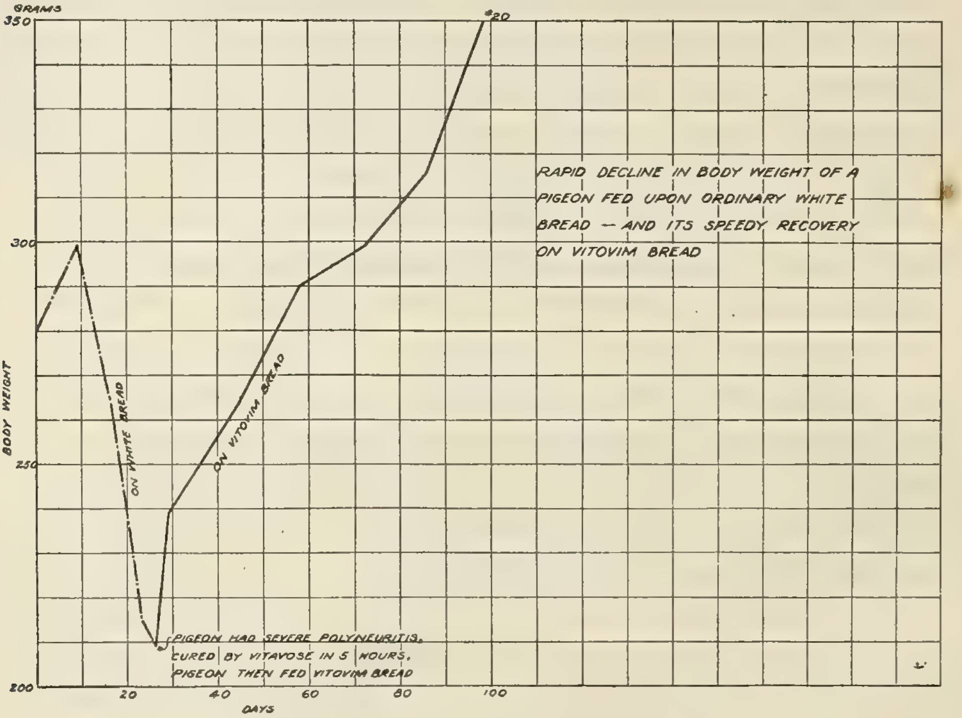


FIG. 5.—Comparison of ordinary white bread and Vitovim bread.

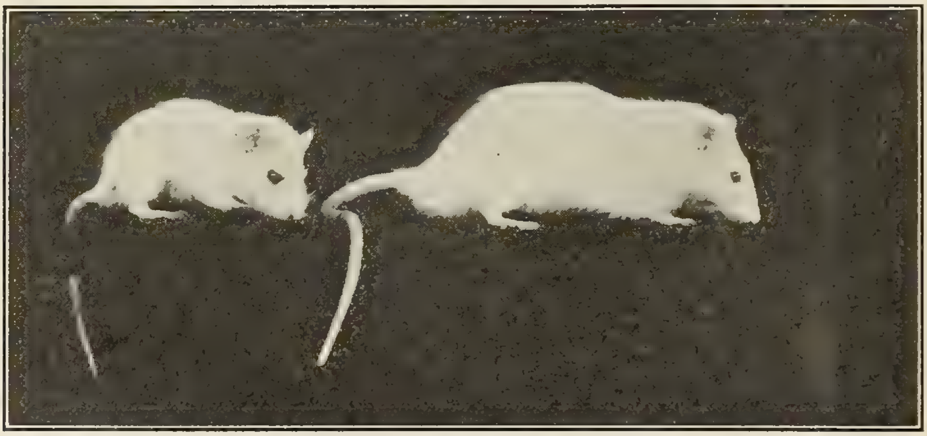


FIG. 6.—The animal on the left and the animal on the right are the same age. The small animal has been fed eight weeks on a popular market white bread and has shown a loss in weight. It died after nine weeks on this diet. The animal on the right shows normal growth. It was fed exclusively on the Vitovim bread made with the wheat germ extract, 10 per cent of whole milk solids, based on the weight of the flour, and 0.5 per cent of calcium salts.

In general appearance, the resultant growth and health of the animals raised on the new loaf presents a sharp contrast to the stunted, sickly condition of the animals that have been fed on the other breads. There is a marked difference on the scales. In one case, the animals show consistent gain in weight, and in the other case consistent loss.

The purpose of such a loaf of bread is to put the food valuables of whole wheat and whole milk into a palatable and economic loaf. The final test is whether, with no other change in the diet, such a loaf will make for better growth and health, particularly among children. Three sets of experiments have been in progress: (1) An institution for children in Boston; (2) an institution for children with 800 or more individuals, near New York; (3) 50 families selected from different nationalities in New York, 25 of which are furnished Vitovim bread and 25 furnished, free, whatever breads they might choose from the local grocer.

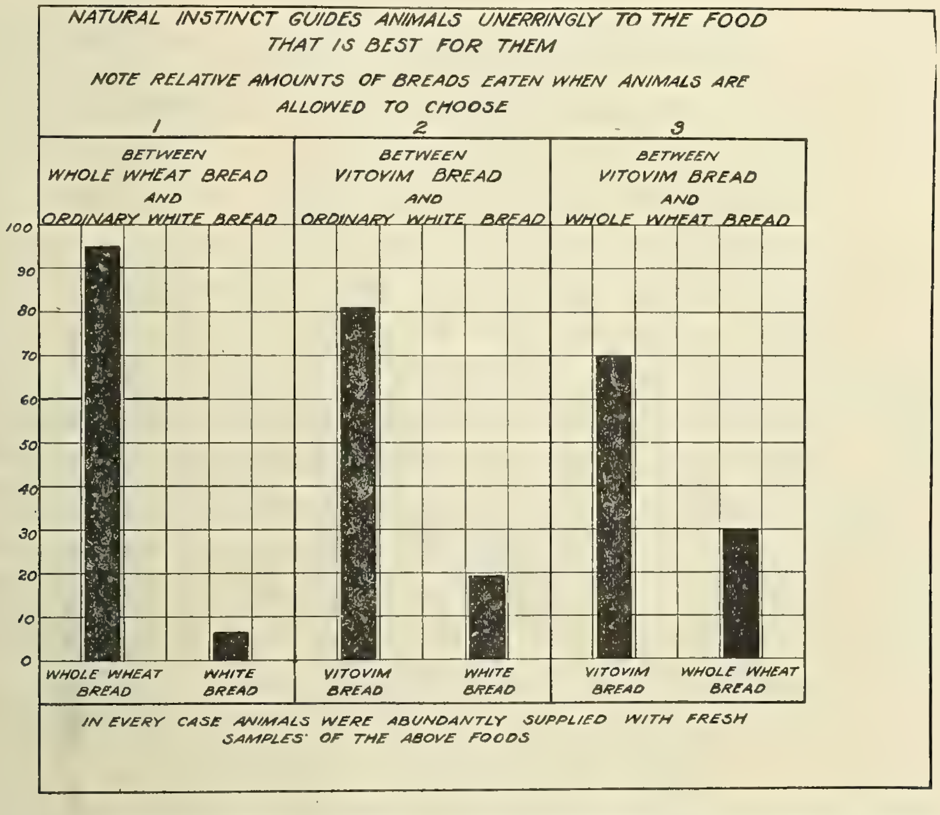


FIG. 7.—Showing tendency of animals to select foods suited to their dietary needs.

In these feeding tests with children the only change in the diet was to supply the Vitovim loaf to one lot and allow the other lot to eat the bread which they had been eating, the bread to both lots being furnished free, without other changes in the diet. Many factors enter into experimentation with children, and the feeding tests must be conducted through much longer periods than with animals for conclusive results. But in all of the three groups of these child-feeding tests the average height and the average weight of the children eating the Vitovim loaf is higher than the average height and the average weight of the children who have the other breads in their diet. The results of these tests already prove that the bread is doing what it was intended to do, namely, helping to standardize diets deficient in the needs in nutrition added to the loaf. These deficient diets are not restricted to the families of the poor, inasmuch as the school surveys show that there is evidence of improper nourishment in the homes of the well-to-do as well as the poor.

These feeding tests with children have been in cooperation with the New York Association for Improving the Condition of the Poor, under Miss Lucy H. Gillett; the Catholic charities of the archdiocese of New York, under Miss Marie Duffin; and Dr. Worth Hale, of Boston. Very complete dietary studies are being made, and the results, when published, will add substantially to existing knowledge of human nutrition.

Chairman Rose. I might add that in my own household when I asked to have two kinds of bread, the ordinary bread and this, I was informed that we could afford the reenforced bread for the children, but the ordinary was good enough for the others.

Mr. Allen. If you want milk, you can get it more cheaply from the loaf.

Chairman Rose. Is there anyone who would like to discuss Mr. Allen's paper?

Captain Golding. I should like to ask if he has done any experimenting with whey in making bread. In Norway they have been experimenting in making bread from whey. I think that would meet the difficulty that Doctor Rose raised about the price. In England we waste between a million and a million and one-half pounds of whey every year, because it is impossible to get sufficient pigs to feed. If dried whey could be used, it would add lime to the bread, or if dry separated milk could be used the breads would be much cheaper. I understand that milk bread in this country must be full-cream milk bread. I would like to know whether it is really the best thing to insist that all milk bread shall be made from full-cream milk when we have waste products which would make a much cheaper bread, and, according to Mr. Allen's statement, add the necessary protein wanted for the nutritive value.

Mr. Allen. Yes; whey will enrich the bread, but skimmed milk and skimmed wheat will not make a nutritional balance. The question is: Can we take the whey or the skimmed-milk solids and put them into the loaf and balance the proteins and have the public understand, for instance, that they are getting just that much food value in the particular loaf of bread? In my own opinion, I think it is just as cheap, in fact cheaper, to take the whole-milk product. We eat butter and need butter. Why not put the butter in the bread as well as on the bread and give the child in one food product a nutritional balance that will more or less standardize the diet?

I want to convey to you this one point of view that has impressed itself very much on my mind: The average American has not the concern, the intelligence, or may not have the economic opportunity to balance his or her diet. In the kitchen many mothers and many cooks take the water from the cooked vegetables and pour it down the sink. They are pouring down the vitamin B, the salts, and the soluble proteins. We have been skimming, straining, and disarranging the nutritional balance in our methods developed to preserve and to tastily serve foods. Each family needs a Doctor Rose to see that the child gets in its diet a standardized amount of these things.

If we put into the bread the dried skimmed milk solids it will help some, but since we can do the whole job so economically, why not put the fat solubles into the bread as well as vitamin B and the protein salts?

Doctor Flickwir. Is there any vitamin destruction during the baking of bread?

Mr. Allen. We find that the loaf is peculiarly adapted to the protection of the A and B vitamin, first, because of the carbon dioxide nature of the fermentation; second, because when it goes into the loaf the heat never affects the inside beyond 98° C. We have found very adequate protection in the process for vitamins A and B.

Chairman Rose. The next paper on our program really continues this subject, and perhaps some of the questions you have in mind will come out there. It is, " The use of milk powder in baking," and will be presented by Mr. Charles A. Glabau, technical director of the American Trade Publishing Co. [Applause.]

THE USE OF MILK POWDER IN BAKING.

Chas. A. Glabau, technical director, American Trade Publishing Co., New York City.

Within the last 10 or 12 years very much scientific work has been carried on with milk products, special attention being given to evaporated milk, condensed milk, and dried milk in its various forms to determine their relative food value as they relate to proteins, combinations of mineral salts, and especially to their vitamin potency.

Experts in nutrition have long recognized the importance of milk in the dietary through the work which they have carried on, and have endeavored to get the people to use more of it. They also have recognized that great quantities of milk, especially skim milk, have gone to waste for lack of consumption. Is it any wonder then that investigators have developed methods of concentrating this product into the powdered state?

SOME GOVERNMENT STATISTICS.

In going over some of the statistics furnished by the United States Department of Agriculture, we find that 1,054,938,000 pounds of creamery butter and 650,000,000 pounds of farmer butter were manufactured in 1921. It required about 55,803,698,000 pounds of whole milk to produce this quantity of butter, which represents about 36.2 per cent of the total milk produced. After the butter has been extracted from this quantity of whole milk, we have approximately 34,987,000,000 pounds of skim milk. Considerable of this milk is fed to hogs and chickens in the form of liquid skim milk, liquid buttermilk, and concentrated buttermilk. Some of it goes into the manufacture of powdered milk to be consumed in a number of other food industries, of which I believe the baking industry is the largest. When fed to hogs it requires I think 7 pounds of skim milk to produce 1 pound of pork. When fed to chickens it requires an even greater number of pounds of skim milk to produce 1 pound of live chicken. It is rather difficult to estimate the quantity of this milk that is fed to stock such as calves, hogs, and chickens, and also rather difficult to estimate the quantity that is converted into powdered milk, and exceedingly difficult, if not impossible, to calculate the tremendous quantity that goes to waste, especially at those times of the year when the cows are most productive.

Having learned through the work carried on by many scientific investigators that milk in all its forms (and that includes the milk solids in the form of dried milk, if properly dried) is one of the most valuable foods which we possess and that it can be used as a supplementary article of food in the dietary to supply the proper kinds of protein, valuable combinations of mineral matter, and vitamins, it becomes very apparent that we should not allow any of this substance to go to waste. but find means of introducing it into other food combinations, especially in bread. When milk is wasted it is not only a loss to the farmer, to the dairyman, and to the community in which he operates, but a tremendous loss to the country at large. This has given much concern to many economists.

It is true that much of this milk is introduced into other foods, such as ice cream, chocolate, beverages, and into bakery products. I do not know how much more, if any, milk can be introduced into the ice-cream industry or the chocolate business, but I do know that considerably more of it could be consumed by the baking industry.

I think it is fair to assume that the baker uses about 20 per cent of liquid milk as the liquid which goes in combination with flour to make dough. That would mean that he consumed about 640,000,000 pounds of liquid milk. The baker can, as you will learn later, use all liquid skim milk, partial skim milk, or whole milk, if he desires, in his doughs, which will not only give him a greater yield, but also increase the nutritive value of the bread or any other bakery products into which the milk is introduced. Let us see how much more milk the baking industry can use in the manufacture of bread.

It is estimated that the bakers of the country consume approximately 40,000,000 barrels of flour per year. If they use 130 pounds of milk per barrel of flour, they would consume 5,200,000,000 pounds of liquid milk per year. This means about 52,000,000 pounds of powdered skim milk. This would surely make quite an impression in the surplus milk, whatever quantity that may be, and tend to eliminate that much waste if the waste is as great or greater than this quantity.

A SHORT HISTORY OF THE BAKING INDUSTRY.

The baking industry is larger than a good many people realize. In the early days of its development the baker paid very little attention to the use of milk in bread and other yeast doughs, although he used some milk in the other products which he made. In those days baking was considered purely as a craft and the baker was a craftsman. What he knew of the baking business was handed down to him from the generation before. The baking business operated under these conditions for a quite a number of years. Gradually business people with greater vision began to see that it could be developed into a very promising business. They became active, built larger establishments, interested the mechanical geniuses, who gradually developed machines which could be used for making doughs, dividing, rounding, automatically carrying the dough through compartments where it was allowed to rise, machines that molded or shaped the bread into the required shape, other automatic apparatus, until to-day we have large establishments where the dough is made and handled automatically from beginning to end.

Under these conditions scientific men were gradually attracted, the problems of the bakery studied, new methods of making and handling the dough were developed, and we now find ourselves in an era of even greater developments where we do not endeavor to determine how much more bread can be produced from a given quantity of materials, but how nutritious we can make the different bakery products.

Twenty-five years ago very little milk was used with the exception that a few bakers used some milk in special types of bread like Vienna bread. This type of bread was introduced by bakers who had made Vienna bread in Europe. The reason for the baker's not using much milk in those days was probably due in part to the fact that he knew very little about milk and also to the inability to procure milk fresh daily.

THE INTRODUCTION OF DRIED MILK.

The manufacturers of powdered milk found it very difficult to introduce their product into the bakery. When it was first put on the market, most bakers could not conceive that milk could be dried to a powder, and when milk powder was mentioned they looked first at the product, then at the man attempting to make the sale with suspicion. Believing that it was some foreign substance to be substituted in place of milk, they would not accept it, and thus it required very hard work and education to get them to use it in even small quantity. As the baker began to get better dried milk he became more interested and gradually introduced larger quantities, believing of course that as he increased the milk content he would increase the material cost of his bread.

As time went on and the baker became more familiar with it, he gradually increased the quantity, and so we have quite a number of bakers who to-day use 100 per cent milk as a liquid for making their dough. They look at it with more intelligence and are more keenly interested in any literature that is presented to them on this subject.

EXPERIMENTAL WORK WITH MILK IN BREAD.

The speaker has for a number of years carried on considerable investigation, not only from a physiological standpoint but also from the economic side. Through these investigations it has been found that the baker can use sufficient milk solids in the form of powdered milk in addition to water so that all of the liquid which he uses in making doughs will be equivalent to liquid skim milk without materially increasing the cost of bread. This seems a rather broad statement to make. Nevertheless it is true. If you will bear with me a few moments I will endeavor to show by means of tables and photographs that the baker can use the maximum quantity of milk in the form of skim milk in bread doughs without very materially increasing his cost.

To make this clearer I have prepared a number of slides of the data collected on some recent work. If you will follow me we will go through the data that is projected on the screen.

TABLE 1.—*Skim-milk powder in doughs.*

	Water-loaf.	25 per cent milk powder.	50 per cent milk powder.	75 per cent milk powder.	100 per cent milk powder.	100 per cent fresh milk.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Flour	400	400	400	400	400	400
Skim-milk powder		6.8	13.6	20.4	27.2	
Fresh milk (whole)						286.4
Water	240	245.0	250.0	256.0	262.0	
Sugar	5	5.0	5.0	5.0	5.0	5.0
Malt	5	5.0	5.0	5.0	5.0	5.0
Shortening	8	8.0	8.0	8.0	8.0	8.0
Salt	7	7.0	7.0	7.0	7.0	7.0
Yeast	10	10.0	10.0	10.0	10.0	10.0
Totals	675.0	686.8	698.6	711.4	724.2	731.4

These data represent the work carried on with six different doughs ranging from a straight water dough to a 100 per cent whole-milk dough. Dough No. 1 yielded 675 grams of dough; dough No. 2, representing 25 per cent skim milk, yielded 686.8 grams of dough; dough No. 3, which is a 50 per cent skim-milk dough, yielded 698.6 grams of dough; dough No. 4, which is a 75 per cent skim-milk dough, yielded 711.4 grams of dough; dough No. 5, which is a 100 per cent skim-milk dough, yielded 724.2 grams of dough; while dough No. 6, which is a 100 per cent whole-milk dough, yielded 731.4 grams of dough. Thus you see there is a gradually increased yield as the quantity of milk is increased. This is not only true when powdered milk is used, but when liquid milk is used either skimmed or whole. The increased yield is due in part to the quantity of milk solids introduced when in the form of powder and to its absorptive property; that is, to the property of taking on water. If we introduce a definite quantity of flour into a vessel and gradually add water while it is being agitated, we will finally obtain a dough which the baker considers has the proper consistency for making bread. If we determine the quantity of water taken on by the flour, we will find that the flour has taken on approximately 60 per cent of its own weight of water to make a dough of the proper consistency. This varies somewhat, more or less, depending upon the character of the flour and the rapidity with which the dough was agitated during mixing.

If we take an equivalent weight of powdered skim milk and go through the same work we will find that the skim milk has taken on from 62 to 67 per cent of its own weight of water to make a paste having about the same consistency as the dough. When powdered milk is introduced into a dough this same property makes it possible to introduce more water. In fact it is necessary to introduce more water to produce a dough of the proper consistency. From this we see that the introduction of milk not only tends to introduce more weight into the dough as milk solids, but also additional water which materially increases the yield.

There are also other properties which must be taken into consideration which tend to not only make better bread when the quantity of milk is increased but also tend to increase the yield. These shall be mentioned a little later.

TABLE 2.—*Skim-milk powder in doughs.*

[Formula and cost on 100-pound basis.]

	Water loaf.		25 per cent milk powder.		50 per cent milk powder.	
	Pounds.	Cost.	Pounds.	Cost.	Pounds.	Cost.
Flour	100	$3.50	100	$3.50	100	$3.50
Skim-milk powder			1.7	.26	3.4	.51
Fresh milk (whole)						
Water	60		61.25		62.5	
Sugar	1.25	.11	1.25	.11	1.25	.11
Malt	1.25	.09	1.25	.09	1.25	.09
Shortening	2.0	.26	2.0	.26	2.00	.26
Salt	1.75	.04	1.75	.04	1.75	.04
Yeast	2.5	.68	2.5	.68	2.5	.68
Total	168.75	4.68	171.7	4.94	174.65	5.19
Cost, per pound basis		.0277		.0287		.0297

	75 per cent milk powder.		100 per cent milk powder.		100 per cent fresh milk.	
	Pounds.	Cost.	Pounds.	Cost.	Pounds.	Cost.
Flour	100	$3.50	100	$3.50	100	$3.50
Skim-milk powder	5.1	.76	6.8	1.02		
Fresh milk (whole)					71.6	3.46
Water	64.0		65.5			
Sugar	1.25	.11	1.25	.11	1.25	.11
Malt	1.25	.09	1.25	.09	1.25	.09
Shortening	2.0	.26	2.0	.26	2.0	.26
Salt	1.75	.04	1.75	.04	1.75	.04
Yeast	2.5	.68	2.5	.68	2.5	.68
Total	177.85	5.44	181.05	5.70	180.35	8.14
Cost, per pound basis		.0306		.0320		.0440

Table 2 shows figures which we have compiled, representing the itemized cost of the different doughs showing that there is not a great material increase in the cost as the quantity of skim milk solids are increased. There is a slight increase only as far as the materials are concerned.

In making bread it is quite customary to weigh a water dough about 18 ounces to produce bread weighing 1 pound about 12 hours after baking. If sufficient skim-milk solids are used so that all the liquid in the dough is equivalent to liquid skim milk, the baker can weigh the dough about 17½ ounces, producing bread weighing 1 pound 12 hours after baking. This gives him still an additional yield which, together with the additional yield shown in Table 1, will produce sufficient extra bread to offset the cost of the milk powder under present conditions. This, of course, will vary with the change in price of the different raw materials such as the flour and the milk used.

TABLE 3.—*Fermentation of skim-milk doughs.*

	Water loaf.	25 per cent milk powder.	50 per cent milk powder.	75 per cent milk powder.	100 per cent milk powder.	100 per cent fresh milk.
Weight:						
Before fermentation .... grams..	666 0	680.5	694.3	704.1	712.0	704 5
After fermentation .... do....	659 2	674.3	687.4	697.8	706.2	699.5
After baking .... do....	595.0	608.5	627.4	642 5	660.0	662 5
Volume after baking .... cubic inches..	121.5	126.5	135.0	142.0	146.0	147.5
Time of making	11.05	11.20	11.35	11.50	12	12.15
Temperature of dough .... degrees..	80	80	80	80	80	80
Temperature of proof box .... do....	80	80	80	80	80	80
First rising time	1.05	1.15	1.20	1.30	1.40	1.50
Volume .... cubic centimeters..	1,800	1,800	1,800	1,800	1,800	1,800
Second rising time	2	2.15	2.15	2.25	2 35	2 40
Volume .... cubic centimeters..	1,600	1,600	1,600	1,600	1,600	1,600
Third rising time	2.30	2.45	2.45	2.50	3	3 10
Volume .... cubic centimeters..	1,250	1,250	1,250	1,250	1,250	1,250
Fourth rising time	2.45	3	3	3.05	3.15	3.25
Volume .... cubic centimeters..	1,000	1,000	1,000	1,000	1,000	1,000
Time into oven	3.45	3.50	3.50	3 55	4.15	4.25
Time from oven	4.15	4.20	4.20	4.25	4.45	4.55
Temperature of oven .... degrees..	440	440	440	440	440	440

In carrying out this work we very carefully weighed the different materials on a sensitive balance, put the required quantity of water at such a temperature so that the dough would have a temperature of approximately 80° when mixed. The salt, sugar, malt, shortening, and milk powder were introduced into the mixer and about 80 per cent of the desired quantity of water was added and the mixture agitated to dissolve the soluble substances. The balance of the water was introduced into the vessel together with the yeast in which was put the solution. The flour was then added, mixing started, and after the materials became partially incorporated the yeast was added and mixing continued until the dough was properly developed. The dough was then introduced into graduated jars and put into a proofing chamber in which the temperature was kept constant, and the dough was allowed to rise through a definite period. You will note as you look at Table 3 that the dough was weighed before the fermentation, after fermentation, and after baking; the volume was also determined after baking. We also took note of the time when made, temperature of dough, temperature of proof box, time for the different risings, and the volume at the end of each rising period was noted. The time required for the dough to bake was also observed, together with the temperature of the oven as you will also see.

There was no noticeable difference in the fermentation irrespective of the quantity of milk used. This same work was repeated using a water dough and graduated quantities of whole milk. The data that are now reflected on the screen show that skim-milk powder and butterfat were used in such quantity so as to make a liquid equivalent to whole milk.

TABLE 4.—*Milk powder and milk in doughs.*

[Formula and cost on 100-pound basis.]

	Water loaf.		25 per cent milk powder.		50 per cent milk powder.	
	Pounds.	Cost.	Pounds.	Cost.	Pounds.	Cost.
Flour	100	$3.50	100	$3.50	100	$3.50
Butterfat			.7	.46	1.4	.92
Skim-milk powder			1.7	.26	3.4	.51
Fresh milk (whole)						
Water	60		61.25		62.5	
Sugar	1.25	.11	1.25	.11	1.25	.11
Malt	1.25	.09	1.25	.09	1.25	.09
Shortening	2.0	.26	2.0	.26	2.0	.26
Salt	1.75	.04	1.75	.04	1.75	.04
Yeast	2.50	.68	2.50	.68	2.50	.68
Total	168.75	4.68	172.40	5.40	176.05	6.11
Cost, per pound basis		.0277		.031		.035

	75 per cent milk powder.		100 per cent milk powder.		100 per cent fresh milk.	
	Pounds.	Cost.	Pounds.	Cost.	Pounds.	Cost.
Flour	100	$3.50	100	$3.50	100	$3.50
Butterfat	2.1	1.39	2.8	1.85		
Skim-milk powder	5.1	.76	6.8	1.02		
Fresh milk (whole)					71.6	3.46
Water	64.0		65.50			
Sugar	1.25	.11	1.25	.11	1.25	.11
Malt	1.25	.09	1.25	.09	1.25	.09
Shortening	2.0	.26	2.0	.26	2.0	.26
Salt	1.75	.04	1.75	.04	1.75	.04
Yeast	2.50	.68	2.50	.68	2.50	.68
Total	179.95	6.83	183.85	7.55	180.35	8.14
Cost, per pound basis		.038		.041		.044

Dough No. 1 again represents the water dough, showing the yield and the cost; dough No. 2 represents a 25 per cent milk dough; dough No. 3 represents a 50 per cent milk dough; dough No. 4 represents a 75 per cent milk dough; dough No. 5 represents a 100 per cent milk dough; and dough No. 6 represents a 100 per cent fresh liquid milk, as purchased from the dairy.

TABLE 5.—*Milk powder and milk in doughs.*

	Water loaf.	25 per cent milk powder.	50 per cent milk powder.	75 per cent milk powder.	100 per cent milk powder.	100 per cent fresh milk.
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Grams.*
Flour	400	400	400	400	400	400
Butterfat		2.8	5.6	8.4	11.2	
Skim-milk powder		6.8	13.6	20.4	27.2	
Fresh milk (whole)						286.4
Water	240	245	250	256	262	
Sugar	5	5	5	5	5	5
Malt	5	5	5	5	5	5
Shortening	8	8	8	8	8	8
Salt	7	7	7	7	7	7
Yeast	10	10	10	10	10	10
Total	675	689.6	704.2	719.8	735.4	731.4

By looking at Table 4 you will notice that there is a gradual increase in the cost as the quantity of the whole milk is increased. This is largely due to the increase in butterfat, which naturally must be increased when the other milk solids are increased. In this work the materials were also very carefully weighed and compounded in the same manner as the skim-milk doughs. The same observations were made and noted as before.

TABLE 6.—*Fermentation of doughs.*

	Water loaf.	25 per cent milk powder.	50 per cent milk powder.	75 per cent milk powder.	100 per cent milk powder.	100 per cent fresh milk.
Weight:						
Before fermentation............grams..	670.8	683.5	695.5	711.2	728	715.2
After fermentation...............do....	664.8	676.1	688.2	705.3	721.2	708.6
After baking.....................do....	604.0	624.0	636.5	650.2	673	664
Volume after baking.........cubic inches..	122.5	128.0	134.5	140	148	146
Time of making............................	9.45	10	10.15	10.30	10.45	11
Temperature of dough...........degrees..	78	78	78	78	78	78
Temperature of proof box...........do....	80	80	80	80	80	80
First rising time.........................	11.45	12	12.15	12.30	12.45	1
Volume............cubic centimeters..	1,800	1,825	1,800	1,800	1,850	1,850
Second rising time........................	12.45	1	1.15	1.30	1.45	2
Volume............cubic centimeters..	1,600	1,600	1,600	1,600	1,600	1,600
Third rising time.........................	1.15	1.30	1.45	2	2.15	2.30
Volume............cubic centimeters..	1,200	1,250	1,200	1,300	1,250	1,250
Fourth rising time........................	1.30	1.45	2	2.15	2.30	2.45
Volume............cubic centimeters..	950	950	950	950	950	950
Time into oven............................	2.35	2.40	3	3.10	3.30	3.45
Time from oven............................	3.05	3.10	3.30	3.40	4	4.15
Temparature of oven..............degrees..	440	440	440	440	440	440

In making the different types of milk bread it will be found that there is a gradual increase in the volume of the bread as the milk is increased. This is very interesting. Very often a baker will tell milk salesmen that he can not use very much milk solids in his dough because it has a binding effect on the dough; that is, it produces bread of a smaller volume. This is true if the baker introduces a considerable amount of milk solids without increasing the water content, thus producing a more solid viscous mass which will affect the gas tension developed during the fermentation period, with the consequence that he gets a so-called bound loaf or bread having a somewhat smaller volume. There is not only an appreciable increase in the nutritive value of bread and in the yield when milk is used, but the bread has a much nicer appearance.

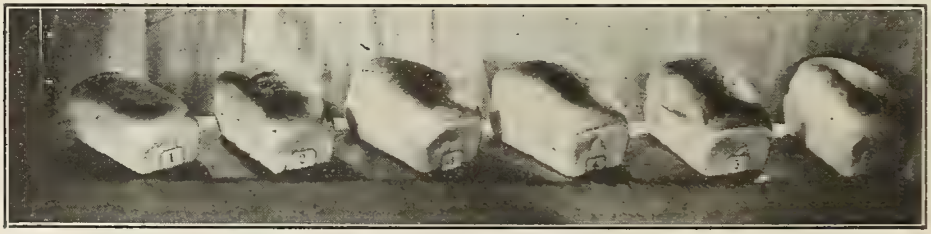


FIG. 1.—Showing increase in the volume of the bread as the quantity of milk used increases.

If you will observe Figures 1 and 2 you will note that there is a gradual increase in volume. Loaf No. 1 is a water loaf, loaf No. 2 represents 25 per cent milk, bread No. 3 represents 50 per cent milk, bread No. 4 represents 75 per cent milk bread, loaf No. 5 represents 100 per cent milk bread, and bread No. 6 represents 100 per cent fresh whole milk as purchased from the dairy.

The bread not only takes on a greater volume but has a much nicer colored crumb, a better interior in the form of a whiter-colored crumb, better grain, softer texture, better flavor, taste, and also a better keeping quality.

I have presented these data and these photographs to you hoping that I may to some extent enlighten some on the use of milk solids in the bakery, especially in bread.

PHYSIOLOGICAL ASPECTS OF MILK IN BREAD.

In getting the baker to use additional milk in his bread you not only promote a great saving but also enhance the food value of our basic food—bread. We hear of work being carried on in every direction to determine the food value of milk and also the food value of bread when milk is used. McCollum and his coworkers of Johns Hopkins are carrying on extensive work; Sherman, Doctor Rose, Mendel, Doctor Allen and his coworkers, the American Institute of Baking, through Doctor Morison and his coworkers, and many others are delving deeper into this work and no doubt will find many things of value in the use of milk in bread.

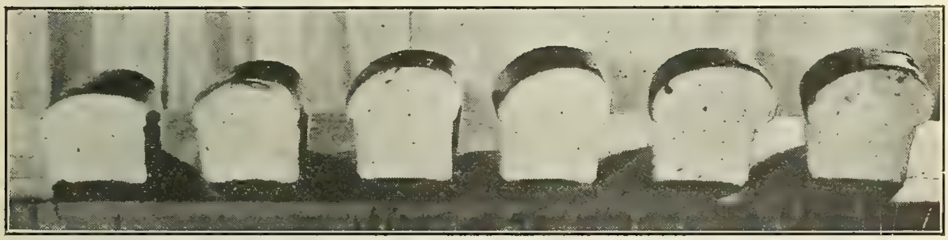


FIG. 2.—Cross section of the loaves of bread shown in Fig. 1.

The speaker has carried on some feeding tests in connection with the work just laid before you. The results of these tests I can best explain to you by a chart. [Fig. 3.]

If you will observe the chart you will notice seven different curves. Before explaining this chart I might state that this work represents the feeding tests carried on through a period of 90 days. The average weight of the rats used was about 80 grams. Curve No. 1 shows the results obtained by feeding a white rat on water bread, curve No. 2 shows the results obtained by feeding on 25 per cent milk bread, curve No. 3 represents the results obtained by feeding on 50 per cent milk bread, curve No. 4 represents the results obtained by feeding on a 75 per cent milk bread, curve No. 5 represents the results obtained by feeding on 100 per cent milk bread, curve No. 6 represents the results obtained by feeding on 100 per cent fresh milk bread as purchased from the dairy, while the upper curve represents the results obtained with the control animal.

The animal which was fed on water bread died at the end of about 71 days, while the one fed on 25 per cent milk bread died a few days later. The others lived through the period of experiment with various degrees of weight, depending upon the type of bread that they received.

By illustrating this last data I do not mean to convey that it is necessary that bread be fully life-sustaining. I feel that the average American family's diet is sufficiently varied so that sufficient vitamins are received without depending upon bread solely for them. I do believe, however, that we should make this basic food as nutritious as possible so that the proper types of proteins, the proper kinds of mineral matter, fat, and some vitamins may be available.

The results obtained will not only manifest themselves in the purse of the Nation but most of all in the condition of health. There are a number of things that we must consider if we are to attempt to get the American baker to use more milk in his products. The farmer in producing milk must endeavor to produce the best possible kind of milk he knows how. To do this he must have the proper kind of stock. He must have the proper housing for the cows so that they will produce good milk, and he must be able to handle the milk under the most sanitary conditions so that he may convey it to the dairyman as a high-quality product. The dairyman, in turn, must handle this product with the utmost care and preserve it, if in powdered form, so that it will not be impaired in any way.

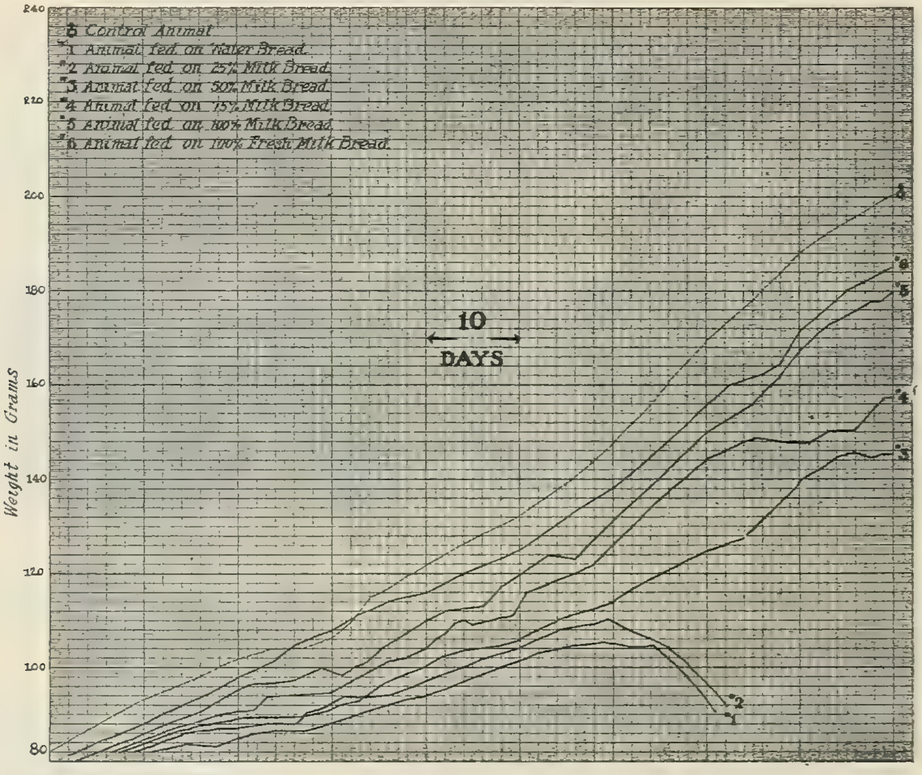


FIG. 3.—Showing growth curves of animals during feeding test of 90 days. ♂ Control animal. 1. Animal fed on water bread. 2. Animal fed on 25 per cent milk bread. 3. Animal fed on 50 per cent milk bread. 4. Animal fed on 75 per cent milk bread. 5. Animal fed on 100 per cent milk bread. 6. Animal fed on 100 per cent fresh milk bread.

The farmer and dairyman should thoroughly study the problems of the baker, become acquainted with him, work with him in every way possible. If this is done I am sure the baker will work with them and ultimately will consume the 5,200,000,000 and possibly more pounds of liquid milk.

Chairman **Rose**. Mr. Glabau's paper is now open for discussion.

Captain **Golding**. If you got a yeast that fermented lactose, would not that decrease the lactose?

Mr. **Glabau**. Yes; in this country we add sucrose and malt extract to our dough, which is fermented by the yeast, so that when milk is used we preserve the lactose.

Mr. **Greene** (San Francisco, Calif.). I would like to ask Mr. Glabau whether it would be advisable to use skim milk in bread and put the butter on.

Chairman **Rose**. That is practically the same question which was raised in regard to Mr. Allen's paper—the advantage of using skimmed milk or whole milk.

Mr. **Glabau**. My opinion is this: I believe we should put some butterfat into the bread so as to get the vitamin A. If we desire to use additional butter on our bread, I would prefer to use milk in the form of skim milk, having the butterfat straight and introducing that separately, so the combination would make what would be equal to the whole milk.

Chairman **Rose**. Are there any further questions?

We are fortunate in having one of our foreign speakers with us this afternoon. We are unfortunate that Doctor Blackham is not present. The secretary has Doctor Blackham's paper and will read it, if you so desire, for the purpose of discussion. It seems to me it would be right to follow your wishes in regard to this paper, inasmuch as we have the printed digest.

Mr. **Estes** (Flint, Mich.). I think it would be interesting to all of us to hear the complete paper, and I, therefore, move that the secretary read Doctor Blackham's paper.

(The motion was regularly seconded and carried).

(Secretary Hoover read Doctor Blackham's paper on "The development of dried milk as a food.")

THE DEVELOPMENT OF DRIED MILK AS A FOOD.

Col. **Robert James Blackham**, M. D., London; late honorary surgeon to the Viceroy of India.

In view of the difficulty of handling and distributing a fluid of which more than 80 per cent is water, it is little wonder that industrial chemists early turned their attention to some means of preventing wastage and economizing the bulk and transport of milk.

Condensed milk was the first result of their labors to produce a less bulky product with better keeping properties, and its success led to still further efforts to get rid of fluid, with the result that as early as 1868 a "dessicated milk" became an accomplished fact.

It is only within the last decade or so, however, that commercial firms have placed on the market on a large scale a substance consisting only of milk solids and capable of being reconstituted by water alone into a fluid more or less identical with fresh, or rather heated, milk.

My attention was drawn to the subject when I was in charge of Government laboratories in the East some 15 years ago, and I carried out a series of analyses and experiments on behalf of the Government of India.

About the same period the Ministry of Health in England found that the manufacture of dried milk was assuming such extensive proportions that one of its medical officers undertook the preparation of a report on the product, and this document was published about five years ago.

The report was decidedly favorable to dried milk, and the development of this important modification of an all-important article of diet has been so remarkable that it seems desirable to bring it to the notice of this congress, with a view to a discussion on the subject.

Dried milk is now chiefly used in Great Britain, the British colonies, and the Indian Empire, but curiously enough it was first suggested as a food for infants by the French in 1904, and in the same year a German observer published an account of the use of dried milk as a food for himself and his infant son. At the National Conference on Infant Mortality, held in London in 1906, two eminent medical men, Doctor Sommerville and Doctor Harper, strongly advocated the use of milk powder, and the present chief medical officer of the Ministry of Health, Sir George Newman, who was then medical officer of health of a London borough, commenced using it at once.

In his annual report for 1907 he said: "Dried milk is an excellent substitute; not for breast milk and not for really good cow's milk, but for much of the milk on which infants are now fed." Since these earlier experiences dried milk has steadily increased in popularity as a food for infants and has won the warm approval of many eminent British and continental authorities.

The product has been employed on a large scale in Leicester, Sheffield, Birmingham, Manchester, Bradford, Liverpool, Birkenhead, Huddersfield, and several London boroughs and its introduction has led to the abandonment of infant milk depots and to the distribution of dried milk in lieu of Pasteurized or so-called humanized milk.

Parallel with the development of the employment of dried milk in infant feeding, there has been a remarkable decrease of the infantile mortality in Great Britain.

This was called attention to by medical speakers at the National Milk Conference which was held at the Guildhall of the city of London on October 16, 17, and 18, 1922—i. e., less than a year ago. Dr. Robert Hutchison, the eminent authority on food and dietetics, said: "I am of the opinion that no inconsiderable part of the decline in deaths from infantile diarrhea which has happily taken place in recent years is due to the ever-increasing use of dried milk for infant feeding, especially among the working classes." It has been estimated that since its introduction on a commercial scale some 15 years ago, the use of dried milk in welfare centers and in various institutions has increased more than 150 per cent, and during the same period the rate of infantile mortality for England and Wales has fallen 43 per cent; i. e., from 130 per 1,000 in 1908 to 77 per 1,000 in 1922—last year.

Of course, many other factors have been at work in reducing infant mortality but the association between the development in the use of dried milk and the marked saving of infant life has been striking.

This rapid increase in the use of waterless milk has been due to the great difficulties in the production and transport of a liquid milk supply suitable for infant feeding, and especially in insuring the use of such supply in the poorer districts of the great towns.

Prof. Leonard Hill has actually suggested that it may be cheaper to dry all milk and distribute it in powder than to attempt to continue our present methods of distribution. Such a suggestion may not be worthy of the consideration of this congress, but it is certain that of recent years there has been remarkable development in the manufacture of dried milk and that already no inconsiderable amount of milk is sold in the form of powder. As this congress is doubtless aware, some 10 processes for the manufacture of dried milk have been put forward from time to time; but so far as I can ascertain, all products at present on the market are prepared by one of two processes, viz., (*a*) the rapid drying of fresh milk on rollers heated by water or steam, and the subsequent powdering of the solids thus obtained with or without the admixture of lactose, or; (*b*) the projection of milk in the form of a fine spray into a chamber with a current of hot dry air, so that the milk solids fall on the floor in the form of fine powder.

The first of these methods claims most adherents, and it is fully realized by the modern manufacturer that no process will make dirty milk into a clean powder and, therefore, arrangements exist to collect milk in suitable churns under special precautions as to cleanliness. By all reputable manufacturers the milk is converted into powder within the shortest possible period after milking, whilst every part of an up-to-date dried milk factory is kept as clean as the proverbial new pin. By the roller process, if the milk is at all acid the cylinders " cry," as the manufacturers say, and the process is difficult so that, as pointed out by MM. Aviragnet and Dorlencourt, the two great French physicians, this is in itself a guaranty to the consumer of the freshness of the milk used in preparing milk powder by the roller process.

In the words of Hutchison, milk must be treated in the process of drying " as the surgeon treats a wound by aseptic methods, remembering that the source of danger is not so much the dropping of germs into the milk out of the air, as gross contamination by dirty hands, dirty vessels and utensils, and by gross purveyors of infection such as the house fly."

I think one of the qualities of dried milk which appeals most strongly to doctors and laymen is the constancy of its composition. Nothing is more notorious than the variation in the composition of the milk of one cow, but Dr. Charles Crowther has drawn attention to the remarkable variation in the milk of small herds as well. He points out that the variation of fat from day to day is not great in either morning or evening milk, when considered separately, but as between morning and evening milk the range of variation is relatively enormous.

He says: "The extremes in samples of undoubtedly genuine milk representing the mixed produce of not less than five Shorthorn or similar cows that have come under my notice are":

	Morning milk.	Evening milk.
Fat (per cent)	2.0–4.3	2.4–5.3
Not fatty solids	8.1	9.7

The upper limits would be raised still higher by the inclusion of Jersey or cows of similar type. Of course, the greater the herd the more constant would be the quality of either the morning or evening milk, but the disparity between the morning and evening milk would doubtless remain.

Crowther purposely drew his illustrations from the small herd "since it is the small herd which is the greatest difficulty in milk control work, and the interests of the small holder can not be ignored in the development of control measures."

Now dried milk of quite constant composition is on the market so that the physician can prescribe it with the same accuracy as a drug, whereas if he orders fresh milk, *or indeed any modification of it*, he is prescribing a "remedy" of more or less uncertain composition.

I have elsewhere drawn attention to the gross impurity of some kinds of fresh milk and need only say here that in conjunction with my friend, Doctor Samut, the well-known Malta bacteriologist, I carried out some bacteriological examinations with regard to dried milk and found all samples free from not only pathogenic bacteria, but all organisms of the Coli group. The only organism we succeeded in isolating was the harmless Hay bacillus.

Now with regard to the adequacy of dried milk for the nourishment of the growing infant, there is emphatic evidence in its favor both in respect to vitamin value and digestibility.

There is no trustworthy evidence that artificial feeding at any period with fresh cow's milk is any better than feeding with heated cow's milk. On the contrary, reliable opinion on the whole favors heated milk against fresh, and the two French authorities I have quoted above point out that heated cow's milk is much less toxic than fresh. Professor Marfan, of Paris, says "cow's milk is better raw than cooked for calves and better cooked than raw for infants."

Controversy with reference to heating has centered around the question of its effect on the remarkable substances known as "accessory food factors" and grouped together as "vitamins."

There has been some failure to realize that there are three varieties known as A, B, and C. A is present in milk fats and to a remarkable degree in cod-liver oil. Insufficiency or absence of A is one of the main causes of rickets. Curiously enough, its absence from a dietary can be compensated for by exposure to sunlight.

B vitamin is a substance found in fruits, vegetables, and milk. Its absence causes the disease known as beriberi.

C vitamin is present in fruits, tomatoes, and tubers and in milk. Its absence causes infantile scurvy.

Vitamin A is not destroyed by the heat, but is weakened by exposure to oxygen. B vitamin is not affected by heat. C vitamin is reduced in quantity by heat. It is destroyed altogether by double heating, reduced considerably by the longer periods of heating at lower temperature commonly practiced, but only slightly affected by rapid boiling or short heating at temperatures near the boiling point.

It may, therefore, be safely asserted that milk loses none of its vitamin content by the process of drying, whereas with commercial Pasteurization there is a tendency to reheat the milk in the home and thus destroy all the vitamin C.

It is twice heated milk that produces infantile scurvy.

With regard to digestibility there can be no two opinions as to the virtues of dried milk in this direction. Goodhart and Hill say: "The chief value of dried milk lies in the firmness and softness of the curd formed by it, which is so much more digestible than that of fresh milk that some infants who can not digest fresh or even peptonized milk, will thrive on dried milk."

In digestive troubles waterless milk is extensively prescribed by leading British physicians, and many French and Belgian doctors regard it as un véritable aliment de choix for such conditions.

In the discussion which followed my paper on dried milk at the Birmingham Congress of the Royal Sanitary Institute, the value of the product in the dietary of typhoid fever and other specific fevers was emphasized; and after considerable experience of the employment of the products in various parts of the world, I have no hesitation in stating that it is much better than ordinary milk in this type of disease, and medical men who used it at my suggestion in Ireland, where typhoid is not uncommon, were eminently pleased with the results.

Indeed, so satisfactory have been these results of the use of dried milk in hospital practice that the replacement of the ordinary supply by reconstituted milk has been seriously contemplated.

There is another type of person with whom the use of dried milk is increasing, namely, nursing mothers.

Many products have been recommended as galactogogues (milk builders) but most medical practitioners are agreed that the best thing to make milk is milk itself. Of course, the important thing about milk used for this purpose is the solids it contains, and a common complaint with women is an inability—or, at least, a reluctance—to take bulky liquids. By giving a reconstituted milk with double or even a larger proportion of the milk solids, one gets over this very serious difficulty to the family physician.

During the war, dried milk was extensively used among the British Expeditionary Forces. I have used it extensively for all purposes in the field both in the field ambulances for the wounded and sick and in "tea kitchens" for healthy men in the trenches and during active operations. My field ambulance commanders preferred it to condensed milk, and the workers in the "tea kitchens" found it admirably adapted for their purpose.

For military purposes, it will undoubtedly entirely displace condensed milk in future campaigns.

Prof. Georges Dreyer, of Oxford University, has said:

> Dirty milk is an evil, but no milk is a worse one. Nevertheless, we have not to choose between these two evils for it is not necessary to put up with either.
>
> For myself, I feel sure that the drying of milk provides us, for the present, with a reasonable solution of our difficulties.
>
> I see no serious obstacle to the efficient distribution to large industrial centers of a clean dried product which will provide a good substitute for fresh milk.

Such, gentlemen, are the main facts with reference to my subject: they offer you, at least, a wide field for discussion.

The eyes of both hemispheres are upon our deliberations, and there can be little doubt that what is said in this room must play a world-wide part with the shaping of public opinion on this big subject of the development of dried milk as a food.

Chairman Rose. You have heard this brief on dried milk. Would you like to discuss it, even though the author is not present to answer questions? It would be obviously unfair to those absentees to read the paper of one and not the other, so I will ask the secretary to read the paper prepared by Dr. Cornelia Kennedy, assistant professor of agricultural chemistry, University of Minnesota.

(Secretary Hoover read Doctor Kennedy's paper on "Vitamins in preserved milks.")

VITAMINS IN PRESERVED MILKS.

Cornelia Kennedy, Ph. D., assistant professor agricultural biochemistry, University of Minnesota, University Farm, St. Paul, Minn.

For some years prior to the present decade, conflicting opinions were held in regard to the vitamin value of milk. This was an important question because milk forms the chief diet of all mammals for a more or less extended period during growth. About 1920 the various opinions which had been expressed on this subject became reconciled through the establishment of the fact that the vitamin content of milk depends primarily upon the food of the lactating animal (1). The origin of the vitamins in milk having thus been established, it seemed expedient also to determine if the vitamins once present in the milk would remain there during any process of treatment to which the milk might be subjected in its commercial usage. Here again much information of a contradictory nature was put forth. However, the greater part of the work done in this connection was concerned with the stability of vitamin C in milk that had been either boiled, Pasteurized, or dried, because this vitamin is much more sensitive to external influences than either vitamins A or B. The chief interest in this work was centered in the study of the effects of temporary means of preservation such as the boiling and Pasteurization of milk, and much confusion arose because the investigators were not careful to define the conditions under which the experiments were carried out. It was only after it had been definitely shown (2) that temperature, time of heating, reaction of medium, and oxidation all play important rôles in the destruction of vitamin C that the presence of this vitamin in some heat-treated milks and its absence in others could be understood.

Without attempting to review completely the work done to demonstrate the presence or absence of the vitamins in preserved milks, attention may be called to some of the more important investigations.

DRIED MILK.

Vitamins A and B.—In 1913, before it had become an established fact that vitamins are necessary constituents of food for normal growth, Osborne and Mendel (3) showed that a food mixture consisting of milk powder, starch, and lard contained all that was essential for the normal existence of rats through at least two generations. This experiment, when viewed from the standpoint of our present knowledge of the vitamin requirements of rats, may be regarded as the first demonstration of the presence of vitamins A and B in powdered milk.

Although vitamin B is probably never entirely absent from the dried milk, the results of various investigations indicate that it is present in varying amounts. Thus McCollum and Davis (4) demonstrated that 2 per cent of milk powder added to a ration complete except for vitamin B supplied enough of this factor for almost normal growth of rats; Osborne and Mendell (5) found that when dried milk was used as a source of this vitamin at least 24 per cent of a diet containing adequate amounts of protein, salts, butterfat, and starch was necessary for inducing rapid growth; and Sherman (6) has found that 0.8 gram of dried skimmed milk per day, or approximately 7.5 per cent of the ration, furnishes the amount of B required for normal growth.

This apparent variation in the amount of vitamin B in dried milk is undoubtedly due to the fact that this factor is not a constant quantity in milk, rather than to destruction of the vitamin by the process of drying. However, there is no definite proof of this assertion, for up to this time the literature contains no reference to comparative experiments in which the same milk was fed in the fresh condition and, at the same time, in the dried form.

Sherman (7) and his colleagues showed that when the diet contains corresponding proportions of fluid or solid milk from different sources there is equality of growth. To arrive at this result they used three groups of experimental animals, giving one group Pasteurized milk, another group milk powder as reconstructed milk, and still another group the same milk powder fed in the dry form. The milk was given in addition to bread, the proportion of milk solids to bread solids being the same in all three cases. As all three groups grew at the same rate throughout a period in which they more than doubled the weights with which they entered the experiment, it seemed safe to these investigators to conclude that the growth-promoting power of milk was not injured by the heat of drying. Johnson (8) has arrived at the same conclusion by feeding groups of growing rats, in addition to a basal ration, which was complete except for vitamin B, a reconstructed milk made of a skimmed milk powder (spray process), a raw milk, and a Pasteurized milk. On each kind of milk his rats made equally good gains where the milk was given in the proportions of 2½ parts of milk to 1 part of ration, thus demonstrating that the heat of Pasteurization and drying did not injure vitamin B. Johnson (9) has also shown that the antineuritic vitamin of skimmed milk powder is not destroyed or reduced in its activity by the drying process. He found it necessary to feed pigeons about 6 to 7 grams daily of skimmed milk powder in order to protect them from polyneuritis. This amount would equal approximately 75 cubic centimeters of liquid milk, an amount somewhat less than Gibson and Concepcion (10) give as the minimum protective amount of fresh milk.

The literature contains very few references to studies of the vitamin A content of milk powders. Sherman (11) has shown that skimmed milk powder contains a significant amount of vitamin A, probably about one-half as much as whole milk powder. He has presented experimental evidence to show that young rats have grown steadily, though at less than one-half the maximum rate, for a period of three months, trebling their weights, and remaining free from xerophthalmia, on a diet in which skimmed milk powder was the sole source of vitamins. Such results can only be obtained on diets containing significant amounts of vitamins. He has also been able to cure rats which have been brought to a typical condition of declining body weight and the characteristic eye disease due to deficiency of vitamin A in their food by feeding skimmed milk powder.

While these investigations on the nutritive value of dried milk were being carried on in the United States, similar investigations were being carried on in England, notably by the medical research committee. The report by Winfield (12) of his experiments on animals with dried milk is of interest in this connection. The manner in which he carried out his experiments differed somewhat from the experiments reported above. The diets which consisted of whole milk powder made both by the spray process and the drum process were offered either in the dry form or as a thick paste with water supplied separately ad libitum. The feeding experiments were begun as soon as the rats could be separated from their mothers, which was earlier than the normal time of weaning. In every case, except a few in which the rats died from accidental causes, the animals remained in good health upon the milk as their sole food. Some of the rats were kept on the diet for a period of 16 months, approximately half of their lifetime, and their general health from all appearances remained perfect to the end of the experiment. Although perfect maintenance was apparently secured on this diet, the rate of growth fell off from the normal when the animals had reached from one-half to two-thirds of their full adult weight. However, it is noteworthy that the addition of fresh milk alone to the diet produced no acceleration of growth, so that the failure in nutrition may be attached to the milk per se and not to the dried preparation. Mattill and Conklin (13) have shown that there is the same retardation of growth between the fiftieth and one hundredth day, approximately the period of adolescence, on both dry milk and fresh milk when fed as the sole food. That this result was not due to a deficiency of vitamin A was proved by the fact that when 10 per cent butterfat was added to a whole milk powder no better growth was obtained. The possibility of a deficiency of vitamin B was also overruled by the fact that satisfactory growth was obtained when starch and lard, which are devoid of vitamin B, were added to the milk powder. Winfield emphasizes the fact that dried milk used as the sole food maintains an animal in good health and permits normal growth for periods which long outlast those corresponding to infancy and early childhood in man.

COMPARATIVE TESTS OF SPRAY AND DRUM PROCESS DRIED MILKS.

Experiments have been recently carried on in this laboratory to determine which of two processes most commonly used for drying milk has the least destructive action on the vitamins of the milk. In the pressure-spray process the milk is first condensed in vacuum at a temperature of 50° to 55° C. and is then sprayed under pressure into a chamber where it comes in contact with a current of hot air at a temperature of 80° to 85° C. and falls to the floor of the drying chamber as a powder. In the drum process a thin film of the milk is allowed to flow directly onto a steam-heated drum where it is dried in a few seconds and immediately scraped from the drum. In this process the exposure of the milk to the ill effects of high temperature and oxygen of the air is not so prolonged as in the spray process and as a result the vitamins which are labile to these agencies are better protected.

The spray-process dried milk used in the following experiments was made from a full-cream milk and the drum-process dried milk from milk from which approximately one-half the fat had been removed. These milks were reconstituted by the addition of sufficient water to give to the resulting milk the freezing point of normal milk and were fed to albino rats to supply either vitamins A or B in otherwise adequate diets in a daily dosage of 10 cubic centimeters per rat. This amount was chosen because it had been found to be the minimum dose that would produce normal growth had fresh milk been used (14). Eight groups of rats each containing 12 rats, divided into two lots, were started on the feeding experiment at intervals throughout the year so that any differences in the vitamin content of the milk due to seasonal changes in the food of the cow could be explained as such and not wrongly attributed to the process used in drying. The results of this work showed that there was a change in the vitamin content of the two samples of milk which corresponded to changes found in fresh milk due to seasonal changes in the feed of the cow. No pronounced differences in the vitamin content of the milk due to the method of drying were found, although the drum-process dried milk gave better growth when this milk furnished vitamin A than when the spray-process dried milk furnished this factor. As part of the fat was removed from the former milk before drying, it must be concluded that the drum process of drying is less destructive to vitamin A than the spray process. Vitamin B did not appear to be affected by either process of drying.

Vitamin C.—The situation is quite different in regard to the presence or absence of vitamin C in dried milk from that which is found with respect to the other two vitamins. In order that milk may retain its antiscorbutic properties after drying, it must be rich in this factor before drying, and it must be dried quickly and at once protected from the action of oxygen. It is not the degree of heat to which the milk is subjected that is all important but rather the time of heating and of exposure to oxygen as well as the initial amount of vitamin in the milk which determine the antiscorbutic potency of dried milk. If the milk is exposed for a considerable period of time to heated air in the course of drying, as in the spray process, it appears to lose much if not all of its antiscorbutic vitamin, but if the drying takes place almost instantaneously on a highly heated drum the action of the air is so slight that the powder retains a considerable part of the vitamin C of the fresh milk. Thus, Hart (15) and his associates found that milk powders varied in their antiscorbutic properties not only because fresh milk varies in its vitamin content, but also because one process of drying may be more destructive to the vitamin than another. In fact, they found that the spray process of manufacture was much more destructive to vitamin C than the drum process. Hess (16) has also shown that milk dried by the Just-Hatmaker (drum) process will protect guinea pigs against scurvy when reconstructed to resemble fresh milk and fed at a level of 80 cubic centimeters daily. Whether this amount would approximate that of fresh milk which is necessary to protect a guinea pig against scurvy can not be stated, as different investigators have given as protecting doses amounts ranging anywhere from 30 to 150 cubic centimeters of fresh milk daily. Furthermore, in order to determine definitely the effect of the drying process it would be necessary to feed the same milk both before and after drying. No experiments of this kind have been reported. Hess has also given evidence that milk thus dried may be stored for a period of at least six months and still cure babies of scurvy (17).

Contrary to these results are those of Barnes and Hume (18), who found that a milk dried by the drum process failed to protect guinea pigs and monkeys from scurvy when fed in an amount equivalent to an amount of fresh milk which protected these experimental animals. These results may have been due to a low content of the milk in vitamin C before drying, or to improper storage conditions, because from the evidence reported in a preceding paragraph it has been demonstrated that the drum process of drying does not entirely destroy the vitamin C.

From this brief survey of the vitamin value of dried milk it may be concluded, so far as can be determined by experiments on animals (1) that milk powders, as a class, contain practically the same amount of vitamin B as the fresh milk from which they were made, whether manufactured by the spray or drum process; (2) that vitamin A is preserved better in drum-processed milk than in spray-processed milk; and (3) that vitamin C will be retained in the dried milk only when the process of manufacture is such as to prevent oxidation and long periods of heating.

POWDERED MILK AS INFANT'S FOOD.

Important as experiments on animals are for obtaining absolute proof that a food substance has retained its initial amount of vitamins, conclusions can not be drawn from such experiments as to the value of the same dried milks in infant feeding. When the rat is used as an experimental animal it must be remembered that its span of life is only approximately 3 years and that when the young rat is weaned and ready to be placed on artificial food its age of 35 to 40 days corresponds to that of a child 8 to 10 years old. Again, when using guinea pigs for the study of scorbutic diets it is well to bear in mind that this animal is much more susceptible to scurvy than a child, often succumbing to the disease in 2 to 3 weeks, whereas an infant may not show the first symptoms for several months. Therefore because of the economic importance of powdered milk, it has been found necessary to determine if this form of milk could satisfactorily replace fresh milk in the dietary of infants and children. This work has been accomplished by actual feeding tests under as controlled conditions as are possible where babies are concerned. There are many difficulties to be met in carrying out tests of this kind, and owing to the comparatively short periods of time over which such tests can extend the results have not been entirely satisfactory. However, the reports of the various agencies carrying on these tests show, on the whole, that powdered milk may be used as a substitute for natural milk. Jordon (19) concludes from his study of 319 babies fed either on modifications of grade A milk, modifications prepared from whole-milk powder, or modifications prepared from milk reconstructed from unsalted butter and skimmed-milk powder that the powdered milk is an adequate food for babies over short periods of time, although there seems to be a tendency for the babies not to do quite so well on a powdered milk for a long interval of time as on natural milk. Hess (17) reports that in his experience dried milk does not lead to scurvy and that it may even contain enough of the antiscorbutic factor to cure scurvy. Winfield (20) has also shown from results obtained from infant feeding that dried milks which have been exposed for a short time to a temperature above the boiling point are not wholly deprived of their vitamins, and that there is no evidence in the large number of records obtained by him that the use of dried milk is associated with any greater tendency to rickets and scurvy than is seen in infants fed upon fresh cow's milk. When whole-cream dried milk was fed he did not observe any cases of xerosis and keratomalacia, a condition which demands careful watching among artificially fed infants. Winfield also reports that the growth curves of children fed exclusively on dried milk from birth closely resemble the average growth curve of breast-fed children, and although at first the rate of growth may be somewhat slower it catches up with the normal and may exceed it. He concludes that cow's milk during the process of drying loses none of the characters which are necessary for the support of normal growth in infants.

CONDENSED MILK.

Much less work has been done on the vitamin value of condensed milk than on that of powdered milk, and there also appears to be less uniformity in the results obtained. Reasons for this lack of uniformity in results are found not only in the methods used in the canning processes themselves, which employ very different heat treatments in different brands of milks, but also in the methods used in determining the vitamin potency of condensed milk. Comparative experiments have not been carried on using the different kinds of canned milk under the same conditions or over long enough periods of time so as to determine if the results obtained were due to seasonal changes in the milk or methods of canning. Unsweetened canned milk (evaporated milk) is preserved by concentration and heating and is given such vigorous heat treatment that vitamin C, the most labile of the three vitamins, is very apt to be entirely destroyed. Condensed milk is preserved by the addition of sugar and by the condensation of the milk in vacuum and therefore is not heated to the same extent as the evaporated milk, and may contain a considerable part of the original vitamin C of the milk. Thus Hess (21) states that condensed milk retains the greater part of its antiscorbutic factor owing to the fact that the condensation process is conducted with very little access to air. No experimental proof is given with this statement. Hume (22) found in feeding experiments with monkeys that milk condensed by the vacuum pan process in which the temperature does not exceed 80° C. and in which there is as slight exposure to air as possible has retained practically all of its vitamins A and C. Hume points out, however, that although the condensed milk when reconstituted to resemble as near as possible raw milk showed little if any vitamin destruction, when it is reconstituted as a modified milk for infants the dilution of the vitamins would probably be such as to make the milk inadequate in its vitamin content. Daniels and Laughlin (23), using both sweetened condensed milk and unsweetened evaporated milk, found that rats made practicaly no gain in weight and speedily died when fed on the latter but made fairly normal growth when fed on the former. They claimed that failure to grow on the evaporated milk was due to a change in the solubility of the calcium in the milk and not to a destruction of vitamins A or B, because purified rations to which the milk was added to supply these factors were adequate to support normal growth.

Contrary to these results are those obtained by Hart (24) and his associates, who found that unsweetened condensed milk diluted so that its solids were equivalent to normal milk and given in 100 cubic centimeter portions daily to guinea pigs had lost its antiscorbutic value. Giorgi (25) has also stated that children in a foundling hospital in Venice became scorbutic when condensed milk was used in place of fresh milk. Ross (26) has reported specific instances of keratomalacia in infants fed on condensed milk.

CONCLUSIONS.

The following conclusions may be drawn from the experiments reviewed in this paper:

1. The presence of the three vitamins A, B, and C have been demonstrated in dried milks.
2. While vitamin B is present in milk dried by either the drum or spray process, vitamins A and C are better protected by the former process of drying.

3. The work that has been done on the vitamin value of condensed milk has not been extensive enough to warrant drawing definite conclusions, although there is evidence that the three vitamins A, B, and C are present in sweetened condensed milk.

4. No definite conclusion can be drawn in regard to the effect of any process used in the preservation of milk on the vitamin content of the milk, as thus far no comparative experiments using the same milk before and after drying have been reported.

5. In general, in order to secure a heat preserved milk rich in vitamins the original milk must be rich in these factors, the period of heating must be of short duration, and the oxygen of the air must be excluded from the milk during the processing as well as in its preservation in the final package.

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Chairman Rose. You have heard this very interesting paper which discusses matters of utmost moment in connection with the use of preserved milks. Would you like to discuss it. some of you who have worked on this problem? If not, this concludes the program as arranged for the session, and we are in a position to adjourn.

(Adjournment.)

SESSION 6. BUSINESS ORGANIZATION.

Chairman, E. G. Miner, president and general manager, The Pfaudler Co., Rochester, N. Y.

Secretary, Leon M. Davis, assistant in marketing dairy products, United States Department of Agriculture.

Y. W. C. A. Assembly Hall,
Syracuse, N. Y., Friday, October 5, 1923—1.30 p. m.

Note.—The delayed arrival of trains bringing delegates from the Philadelphia session to Syracuse, necessitated the postponement of this session until the afternoon. However, some of the delegates held an informal meeting in the morning. At that time the first three papers were read and discussed. One paper, "The function of the local bank in financing the farmer," was read by Mr. Harshaw at both meetings and the discussion, as here given, has been combined.

Chairman Miner. The first speaker who is present to read his paper, is Mr. E. B. Harshaw, cashier of the Grove City National Bank, of Grove City, Pa. Mr. Harshaw.

THE FUNCTION OF THE LOCAL BANK IN FINANCING THE FARMER.

Edwin B. Harshaw, cashier, Grove City National Bank, Grove City, Pa.

As far back as 1859 Abraham Lincoln said, in a speech before the Wisconsin Agricultural Society, "Population must increase rapidly, more rapidly than in former times, and ere long the most valuable of all arts will be the art of deriving a comfortable subsistence from the smallest area of soil. No community whose every member possesses this art can ever be the victim of oppression in any of its forms. Such community will be alike independent of crowned kings, money kings, and land kings."

We are just now beginning to realize the truth of this statement. It is generally acknowledged that agriculture is the basic foundation of our country's progress, but from the fact that it seems so easy to get into, compared with manufacturing and business, it receives very little attention from our financiers. As bankers and business men we have only visualized in single units; while comparing farming with other industries and business enterprises farming seems too small.

We forget that there is twice as much capital invested in the farms of the United States as there is in all the manufacturing plants, transportation, and other industries and that one-fifth of our total income is from agriculture.

Railroad and mill employees, as compared with farmers, furnish only a small proportion of productive labor, and the farmers are the stability of our country.

Without investigation we would naturally think that railroad employees would outnumber those in any other line of business, but in 1921 there were seven times as many employed on the farms as on the railroads. The same is true of men employed in plants making iron and steel products. In fact, one-fourth of the persons engaged in gainful occupations are on the farms.

An analyst employed by the Government finds that the farmer's purchases pay the wages of 797,584 workers in industry and that these wages amount to $855,245,869.

One can easily see what the prosperity of the farmer means to our country's prosperity and how we should be exercised regarding his proper financing.

There can be no doubt in the minds of any that in the deflation from war prices the farmer has received the worst of it, and compared with manufactured products and labor, his returns are much nearer a pre-war basis, while on account of the maintained high cost of labor and materials, and the cost of transportation, his purchases are largely out of proportion to the selling price of his products. It takes 63½ dozen, or 762, eggs to pay a plasterer for one day, or eight hours' work. It takes 23 chickens, weighing 3 pounds each, to pay a painter for one day's work in New York. It takes 42 pounds of butter, or the day's output from 14 cows, to pay a plumber $14 a day. It takes a hog weighing 175 pounds, representing eight months' feeding and care, to pay a carpenter for one day's work.

To stabilize the farming industry it will require the best thought of the business man and economist as well as the farmer.

WHAT THE FARMER NEEDS TO-DAY.

No one denies that proper financing is one of the first great needs of the farmer. In a certain way he has been taken care of, but it has cost too much and it has been for a too indefinite time.

Our country's prosperity will always depend on the success of the farmer. When the farmer is unsuccessful, when he can not find a market for his crops at a satisfactory price, an opportunity is presented for some leader with false ideas to start a propaganda to raise the prices of farm products by some short cut, usually by Government interference in a wrong way, sometimes in the increase of money supply, even today, overlooking the condition in Russia and Germany augmented by their plentiful rubles and marks.

Two problems, if properly solved, will go a long way to place the farmer on a stable footing and they both go together, cooperative marketing and proper financing.

Even with an established market, the individual farmer being such a small unit, finds that the expense of selling his products individually is out of proportion to his profits.

Most farmers have made a study of and understand cooperative buying, but few have made a study of and understand the much more important subject cooperative marketing.

The plan of cooperative marketing has been fully worked out in manufacturing and merchandising. When there is group capital a corporation is formed and the laws of each State have made provisions for it, but the farmer has been overlooked mainly because we have failed to see his need and because his problem must be handled differently. The lawmakers have thought that because the farmer produces individually his marketing is also an individual problem.

The same applies to the better and more economical production of his products. Because of the grouping of capital in corporations, they are able to have experts in production, selling, and costs, but because of the small units in farming the individual farmer is prohibited from employing experts to direct his different farm problems on account of the high cost, therefore it must be done cooperatively.

On account of the vital interest of the whole population in securing more effective results in production at cheaper costs the Federal and State Governments are justified in spending money as they do for this very purpose.

A sure marketing program for the farmer can only be worked out on a collective basis. The individual farmer can not become both an expert producer and distributor. If he could, individually, his volume would not, for a single farmer, justify such a program.

It is necessary that he have experts in the distribution of his products, men handling the marketing of many farms, so that the volume will justify the hiring of them.

In sections of the United States we are rapidly developing such a system. The Pacific States are taking the lead. Practically all of the agricultural industries in California are organized. Ninety-seven per cent of all the berry growers in central California are in one organization, 86 per cent of the almond growers in another, 92 per cent of the raisin growers are organized, 83 per cent of the apricot growers, 80 per cent of the prune growers, over 75 per cent of the walnut growers, and 80 per cent of the peach growers. The organizations are now handling products in excess of $250,000,000 annually. Even the egg producers, perhaps the most difficult of all, are successfully organized. They have under contract 2,300,000 hens and will handle over 23,000,000 dozen eggs, and the egg producers under the system of sorting and storing are taking warehouse receipts and, when necessary, going to the banks and borrowing often as much on the receipts as they were formerly getting for their eggs, leaving a margin as additional profit and giving the banker a desirable loan which, if necessary, he can rediscount at the Federal Reserve Bank.

To be successful the cooperative organizations will be made for business only. No politics or social affairs should be allowed to enter, and competent and experienced men must be employed at a salary adequate to engage them, and they must be given scope to operate successfully.

An outstanding example of cooperative marketing in a small way is the development of the Grove City community. Starting six years ago with only five farmers in the community who had purebred cattle on their farms, they have to-day a community with 300 farms on which there are purebred animals worth $3,000,000. This community is completely organized for agricultural development and marketing.

The marketing plan is only two years old and in the past year has sold over $100,000 of purebred dairy cattle. The association is called the Grove City Dairy Cattle Show and Sales Association.

No one can become a member unless his herd is tested for tuberculosis and he signs an agreement to represent every animal sold exactly as it is. In case a disagreement occurs between buyer and seller after the sale is made, if it can not be adjusted by them it is referred to the directors of the association, whose judgment is final. This association has created a spirit of fellowship and helpfulness among all of the breeders which is talked about whereever known and has set an example for the whole country.

The association is maintained by a $10 initiation fee and $5 per annum dues, in addition to which, each member contributes 5 per cent of the sale price of cattle sold off the farm for dairy or breeding purposes.

At the present time Mr. R. R. Welch, with a stenographer, handles all of the business of this association, but it is growing so rapidly that an assistant is needed.

So much for the marketing of the livestock. The milk products are also handled cooperatively through the Grove City Creamery.

In 1915, the Federal Government decided to establish a creamery for the purpose of putting into operation on a commercial basis the experiments worked out in their laboratories, and we were fortunate in having it located at Grove City, Pa. The community has invested in the creamery and equipment $125,000, and after the interest on the investment and upkeep and running expense of the plant are paid, the producers share the profits in proportion to the milk furnished.

The farmers of the community are receiving about $300,000 per annum for the milk products sold through the creamery.

THE FARMER'S MARKETS.

With the increased cost of transportation of all kinds a serious problem is confronting the farmer, the expense of getting his produce to markets. Relief, in the way of reduced rates, is a long way in the future. Some other solution must be found, and the easiest solution is the study of local demand, and the accommodation of the farmer to it. A study of Federal and State reports shows that the ordinary farmer is still raising the grains and food products year after year which that community has been raising for years, while the population is growing more dense and an entirely different variety of products is in good local demand. A study of the problem will show the farmer what is demanded at his door and he can supply it without transportation cost and at a profit.

FINANCING THE FARMER.

All of the farmer's problems at some point touch his proper financing, and always the local bank must be his main source of supply, but many times in the past the local bank's resources were not sufficient at crop-moving times and again the farmers' turnover was not rapid enough to give the banker a liquid loan.

Several real financial panics were necessary before we were able to establish the Federal reserve system; now it is considered absolutely necessary. Yet we still need some adjustments to take care of our agricultural interests.

The successful way to handle any problem is to find the man who knows and while knowing is on the ground and can see the progress of the problem at first hand and is in a position to be in constant touch with it. In all of these matters the local bankers are preeminently the men.

There are three kinds of credits which the farmer needs: Long-time credits, intermediate credits, short-time credits.

Until recently the farmer depended for his long-time credits on individuals and mortgage companies, both of which were too expensive and in other ways unsatisfactory.

Individuals and mortgage companies loaned only for three or five years at the outside, making renewals necessary, and renewals are always expensive. Finally in 1916, the farm loan act was passed providing for a Federal Loan Board, with headquarters in Washington, which has general supervision of the system. Twelve farm loan banks, in as many districts, each with a capial of not less than $750,000, are provided for.

These banks were organized and are now functioning for the purpose of permitting the farmer to purchase, equip, and improve farm land, or for the purpose of liquidating existing indebtedness on such land.

The loaning capital is raised by the issue of tax-free bonds to an amount not to exceed 20 times the capital stock and surplus, using the farm mortgages as collateral. The Secretary of the Treasury was permitted by a war measure to purchase these bonds, and in 1923 the Government owned over $100,000,000 worth of them.

The same act provides for the organization of joint-stock land banks, with a capital of not less than $250,000. These banks are under the general supervision of the Federal Farm Loan Board and are subject to about the same regulations as are the land banks with the exception that they are privately owned corporations under Government supervision, but the stock is not subscribed for by the Government, which makes them to a certain extent similar to national banks. The loans by these banks are not so limited as to purpose as are the loans made by the land banks. The rate of interest charged is not determined by the Federal Farm Loan Board, except that they shall not charge more than 6 per cent. The banks are permitted to issue bonds up to fifteen times their capital stock and surplus. The loans made by the joint-stock land banks and the Federal land banks are made for not less than 5 years nor more than 40. Practically all of these credit banks provide an easy method for the farmer, as the loans are made on the amortization plan.

To provide for the intermediate credits of the farmer, an act was passed on March 4, 1923, known as the agricultural credits act of March 4, 1923.

This act provides for the establishment of two credit organizations, the Federal intermediate credit banks and the national agricultural credit corporations.

Under this act an intermediate credit bank can be established in each of the cities where Federal farm loan banks are located. Each one of these intermediate agricultural credit banks has a capital stock of $5,000,000.

The stock is Government owned; and while there is no retirement of it, this act provides that the earnings shall be divided between surplus and the Government.

The purpose of the credit banks is to discount loans made by banks for agricultural purposes. Each bank may issue bonds up to ten times its capital and surplus, and the rate of discount shall not be less than 1½ per cent less than the rate charged the borrower.

The bonds issued shall mature in five years, and the banks are examined at least once every year by the Federal Loan Board.

National agricultural credit corporations may be formed by five or more natural persons, but such organization must be approved by the Comptroller of the Currency.

Every corporation must have a capitalization of not less than $250,000, and any member of the Federal reserve system may, with the approval of the Comptroller of the Currency, invest a sum not exceeding 10 per cent of its capital and surplus in the stock of credit corporations. The entire capital stock is to be subscribed by private individuals or corporations, and the Government is not a stockholder and has no direct financial interest whatever in these credit corporations.

Under regulations prescribed by the Comptroller of the Currency, the credit corporations are authorized to discount or purchase notes, drafts, bills of exchange drawn for agricultural purposes which have a maturity at the time of discount of not more than nine months. The loans must be secured by warehouse receipts or other documents giving title to nonperishable and readily marketable farm products, or a first lien on livestock for market or for breeding purposes.

These banks may also invest not over 20 per cent of their capital and surplus in the stock of rediscount corporations organized under this act. They may charge interest at the rate allowed by the laws of the State in which such corporation is located, but not in excess.

Credit corporations may issue debentures with a maturity not exceeding three years to which obligations held by these corporations are held as security. Practically all of the details in connection with the issue of debentures are under the direct control of the Comptroller of the Currency, but the Federal Government assumes no liability for these debentures.

Another feature of the credit corporations is that every credit corporation must keep on deposit with the Federal reserve bank of the district United States Government obligations equal to 25 per cent of its paid-in capital, or 7½ per cent of its indebtedness, depending on whichever sum is the larger.

Some people are of the opinion that amendments to the Federal reserve act permitting country banks having capital of less than $25,000 to become members would help the farmer get his needed credit and would help the banker extend this credit by allowing him to discount with the Federal reserve bank agricultural loans, as the country bank, the bank of smaller capital, is really after all the greatest means of extending credit to the farmer.

Summing up the whole proposition, it seems as though we have now arranged for an adequate plan to finance the farmer for all of his different kinds of credit needs. The machinery is still new and will no doubt require many adjustments.

To my mind, it seems as though we could have used to advantage more of the credit machinery already in operation and which has been so successfully taking care of the business and manufacturing interests.

To safeguard the system and make it successful it will be necessary to provide some means of interesting the country banker in the system, and if this is done there can be no question about the farmer's needs being taken care of in a safe and sane manner, and the agricultural credit banks will fulfill their mission.

An increasing interest in the problems of agriculture is being shown by the business men and bankers in the larger centers. They are beginning to realize more fully that the prosperity of business depends on the purchasing power of the farmer and that a curtailment of his output means stagnation.

Agricultural production is seasonal, but the farmer's products are consumed the year round, and if they are thrown on the market immediately after harvesting in a lump the market is overbalanced, while if they can be financed by the producers or their organizations, the crop can be marketed in an orderly way, thus stabilizing the whole industry.

Agriculture should not be satisfied with anything but the best system of financing, and while there may be many things in our system, as now outlined, which will need revision as it is being practically worked out with the interest taken by the business man, banker, and farmer, and the groundwork so ably placed, the proper financing of the farmer and dairyman is assured. I might say in closing that the American Bankers' Association held their meeting in Atlantic City two weeks ago and one-third of the meeting was devoted to the study of better agriculture. With the interest that is being taken, there is no question but what the financing will be worked out, and there is no question at all but what the financing of the farmer to-day through the banks is very much better understood and very much better looked after than in the past.

Chairman Miner. According to the rules, gentlemen, Mr. Harshaw's paper is now open for discussion.

Mr. Caldwell. I would like to ask Mr. Harshaw if the joint-stock land banks return any dividends to the borrowers.

Mr. Harshaw. Not to the borrowers, although the borrowers only get dividends in the farm loan banks on the amount of stock they own.

Mr. Caldwell. I was director in one of the farm loan associations Every six months there is a dividend returned to the borrowers in proportion to the profits of the bank of that period. I noticed you didn't mention that in connection with the advantages.

Mr. Harshaw. It is a stock proposition.

Mr. Caldwell. It has always seemed to me that any farmer that had a safe loan would always get it through his local bank.

Mr. Harshaw. He can get it through his local bank, although in many sections the local bank at the period does not have sufficient funds to take care of it unless he has some way of going to the Federal reserve bank, and the Federal reserve banks only take commercial paper or agricultural paper. If they had this warehouse receipt plan there would be no trouble at all. The mortgage loans, however, are too long and not liquid enough for the local bankers to use, and this joint stock of the farm loan banks takes care of that.

I just want to say that there is a plan like this at the Government experimental creamery at Grove City, and if any of you come there I will be glad to take care of you. It is in Mercer County between Pittsburgh and Erie.

Chairman MINER. We have had some pretty interesting papers at this congress, and we are going to have some more, but I regard the one you have just heard as one that contains a good deal of meat. It affects some of you gentlemen from various angles. There are some big producers here and I see also some very large handlers in one of the largest cities in the country, if not in the world. I don't know how it appeals to them, but from the quality of the people I see here I think you gentlemen ought to discuss this in a very able fashion. It is open to you. How about our friends from the West? I see some of the largest western dealers are here.

Dr. C. L. ROADHOUSE (of California). In 1917 I visited Grove City for a few days and had the pleasure of meeting the author of this paper and attending a meeting of dairymen that were met to consider the purchase of another carload of purebred animals. The extension worker from the Dairy Division of the United States Department of Agriculture was present and the local banker whom you have listened to in reading this paper. And during the course of the afternoon arrangements were made for the extension worker with such dairymen as desired to make a trip with him for the purchase of cattle, and orders from others who could not make the trip, meant the beginning, I think, of the work which has been explained by the speaker.

I was impressed with the building up, the rapid building up of this community, which, I believe until the Federal creamery was located at Grove City, was not recognized in the community. I have used this community as an illustration in farmers' meetings and dairymen's meetings since that visit to Grove City, and I believe it illustrates what can be done when dairy farmers and local business men and dairy extension workers come together to work out a community problem together.

As I recall it the various extension programs—such as the purebred bull campaign, the silo campaigns, and such similar various extension activities were applied to the Grove City dairy community, and it appealed to me as being a real development along those lines.

Mr. HARSHAW. You will be interested to know that it was the first county of Pennsylvania free from tuberculosis.

Chairman MINER. There are several angles to this discussion still. gentlemen.

Mr. E. W. LANGFORD (of England). I am pleased that we were given an opportunity of listening to this paper. I think it has been one of the most important since the congress began, and I take it the gentleman who read the paper was addressing these remarks in the paper to farming in general rather than to the dairying industry in particular.

Mr. HARSHAW. Yes; although that applies to the dairy industry as well.

Mr. LANGFORD. It is rather more that phase of it that I would like to briefly touch upon this afternoon.

One is glad, of course, that the bankers are taking a keener and a wider and, if I may say, a more intelligent interest in the financing of the farmers. In my little country, England, we think there has been too little attention paid to the financing of the farmers. In fact, the cities and towns have not paid sufficient attention to the purchasing power of the farmers and the influence of a declining agriculture upon their sales.

What I want to touch upon this afternoon is this: I know that there are a vast number of farmers who are inadequately financed. Therefore it would be a great deal of assistance to them to be able to get accommodation from the banks. But there are those, I suppose, in this great and important country, as well as in every other country, and there are a few in my own little country, who have sufficient capital to adequately finance their business. Perhaps as the breeding ground of the world I may say we have purebred stock. We have learned the advantages of using only purebred suitable bulls, whether it be for dairying, or for beef production on the other hand. But at the present time we can not produce crops, whether it be cereal crops, on the one hand, or beef, on the other, at a profit; and I don't want to throw cold water upon the very excellent paper and remarks that were made this afternoon. But there is another side to the question of trying to lift the industry and put it upon a profitable basis.

Some two years ago we had in our country a tremendous amount of surplus beef, no end of graziers and cattle. Many of the farmers borrowed money at the bank and had ample security to give to the bank and expected when they sold those cattle that they would be able to discharge their liability to the bank and have some profit held over. But, unfortunately, that was not the case, and many of them became financially embarrassed because, having sold their stock after the stock had consumed their crops, and after giving to the bank all they made from the stock, they were still owing to the bank a vast sum of money.

What I do want this important, although small meeting, to appreciate is this—that something has got to be done to lift the industry so that when you grow your wheat, when you produce your mutton, when you have reared and fatted your cattle, it is only a question of whether you can set it in the world's economic market at the price of cost of production plus profit. And that is, I think, one of the problems we are up against.

I was pleased to hear the opening remarks of the gentleman who read the paper and the quotation of that fine old statesman, Abraham Lincoln. We in our country think an immense amount of him. And if I understood the quotation right, it was Abraham Lincoln who foresaw the time when a farmer by scientific assistance and his own energy would be able to make two blades of grass grow where one grew before.

In our country we have endeavored to do that, but we have come to the point now as to whether it will not in the future be more profitable to the individual farmer rather than grow two blades of grass where one grew before, rather than grow 5 quarts of wheat where 4 grew before, whether it wouldn't pay him to attempt to grow per man power rather than per acreage. Whether it will not pay the man better to apply the law of diminishing returns to the land, and when he has achieved and got a smaller crop, whether there will not be more profit left to him out of the smaller crop because he has expended less upon his land, less in labor, less in manures, less in actual tillage of the soil. He might, in self-preservation, be forced to adopt that method, as I said before, of the law of diminishing returns rather than grow maximum crops at a cost which will leave nothing to himself. That is from the standpoint of the farmer.

When we come to the standpoint of the community, it is a very different thing which obtains, and it is for the community to say whether they are going to allow the farming industry to decline in this and other countries, and it does become an extraordinarily difficult problem to know what to do to assist the industry at the present time. It would appear that all over the world foodstuffs are being produced in greater quantities than the economic demands for those goods.

I appreciate, probably as you do, that at the present time the world is probably consuming at as low a point the foodstuffs that we produce as it has for a very long time. It may happen that if industry improves all over the world, and if labor is absorbed into industry, wages may improve to a great extent, and it may happen in a very short time there will be better demand for foodstuffs. And if you apply the law of supply and demand, it may easily happen that the prices may go up in order to make these branches of farming profitable.

But so far as to-day is concerned, and in order to tide over the very difficult circumstances, the farmer is really up against a very serious problem, and we cordially, I take it all over the world, thank and are grateful to the financiers of the world in applying some thought and we hope some keen interest in assisting us over what I hope is only a temporary period. [Applause.]

MEMBER FROM PENNSYLVANIA. I am from the same State as the speaker, only the other end of it.

When I was a boy the first time I ever heard Roosevelt talk he said the best sort of a way to build up a nation was to help each man to help himself, and somehow or other that always stuck to me, and the older I grow the more important it is.

We look upon the work that the Grove City National Bank is doing—that means the community—as close to the acme of perfection in the dairy line as most of us know of. We in the neighborhood always tell anybody buying milk about Grove City. We have paid the expenses of some farmers to go there from the rural communities to get the education. We have a difficult task to get them interested enough to go. But there isn't any question if you get them interested they will go. I have often told the bankers that the farmer doesn't understand them. If a farmer knows he has to go to the bank to borrow $500 he won't enjoy his breakfast that morning. You have got to get him to get the vision first and he can play the banker game as well as the banker can play the farmer game, and it makes him a different man. It has helped lots of our farmers and bankers to get mixed up, and it has been quite instructive in developing the dairy business where we are interested. And it has been a big help to us in that indirect way.

Mr. Harshaw. Our bank, when we started this seven years ago, had resources of $765,000. The old bank had resources of $1,200,000. At the last call our deposits were $1,800,000 and their deposits were $800,000, showing we had gained so much more. And that should be convincing enough to any banker. That ought to convince any banker that this does pay in a dollar-and-cents way.

You spoke about increasing the production. In our country the farmers are paying so much more for things that if we had not gone ahead as we have and raised so much more per man and gotten on a so much better production basis, I don't known what we would have done to-day. I think that still continues here.

Chairman Miner. I think, at the risk of violating one of the ordinarily accepted conditions as the chair, I would like to speak for a minute as a member of this conference, and I reply now to the gentleman from England, who, as you all know, is Mr. Langford, the chairman of the produce and dairy committee of the National British Farmers' Union, which represents something around 125,000 to 130,000 men. So he speaks from a very deep conviction and experience.

I don't know anything about the details of dairying or the details of agriculture, although I regret to say I have a ranch down in Texas and some corn land in Illinois which isn't producing as much as I would like to have it. But the fact remains as a manufacturer I must look at this thing from a little different angle. Thinking of it the other day, I was driving through Illinois in a motor, and I drove past a piece of land 60 acres in extent, which I can remember for 30 to 35 years as a boy because it was owned by a very wealthy man for a farmer in those days. He had three three-horse plows break up that stubble on that land. I drove by there the other day. One man with a Ford tractor was taking care of those 60 acres. In other words, the land which formerly had been devoted to the raising of the food for nine horses and two men, was now, of course, being turned into productivity. It was the use of the machinery on that farm.

My grandfather was one of the pioneers in the West. The deeds of the land were signed by the old Patent Office under Andrew Jackson. Some time ago I had one of my auditors sit down and figure the amount of time that it took him in the fifties to produce a bushel of wheat and the amount of time that it takes now to produce a bushel of wheat. When he was in his heydey and land was high and wheat was good, the land was richer than now, it took about 2 hours and 30 minutes of human labor to produce a bushel of wheat. Now it takes about 10 minutes to produce a bushel of wheat.

Just look at it in another way—from another angle. Last year between 1,500,000 and 2,000,000 men left the farms and went into industry in the cities. Yet with that shortage of men we are producing now more than 200,000,000 bushels of wheat upon the same land that we had in tillage in 1913. You see, we have substituted for the human element the machine, and I don't think we have quite taken that factor into consideration in our discussion of the immediate troubles.

I regard this as one of these curves that you sometimes see plotted in the history of the commerce of the country. I think pretty soon we are going to take a lot of more men out of agriculture, put them into industry without any detriment whatever to agriculture. That sounds very heretical, but I think perhaps you will find the panacea of your trouble will be there.

I beg your pardon for trespassing upon your time. [Applause.]

Mr. M. D. LINCOLN (of Ohio). I have wanted to meet this man for a long time because I had the good fortune back in 1915, I believe, to be the first banking man to give his full time to developing agriculture. In Brockton, Mass., a little city bank there started the very work that Mr. Harshaw has carried on so well and finished up better than we did. And from that town I came to Cleveland, under the direction of Myron D. Herrick, who was one of the pioneers in feeling that there was a real place for the banker to take a more active interest in the economics of agriculture.

I think in all of our early work as agents for banking institutions we did what the gentleman said here—we directed our activities entirely to the question of production, and it is only recently that we find the Bankers' Association—and I know the Ohio Bankers' Association has just gone on record first favoring a cooperative marketing, and then stating that they felt it was high time that the farmers as business men and the bankers as their financiers made a very intelligent study of two things: Economical production as well as economical distribution.

I believe we as farmers—I have always been connected with farming in one way or another—have made the same mistake. We have just blindly produced. A manufacturer would think it folly to continue to pile up his warehouses if there was no consumptive demand. That is what I believe Mr. Waid was asking here when he asked if in this statistical work we were going to give an equal amount of time to studying consumptive demand and methods of increasing consumption as we do in increasing production.

I think to-day the farmer needs rather than more capital, perhaps, information and help on the more intelligent use of capital. We have always been concerned with the large number of inefficient producing dairy cows. I wish there were some way whereby the bankers, or somebody else, could just make the farmer get rid of those boarders. I believe if we milk fewer cows and feed those we have better and keep the most efficient producers, our problem of low returns to the dairyman would be in a large way done away with. And I believe now, with the development of cooperative marketing, or even without that, there is another problem that the country bankers and the farmers can well afford to look into, and that is some way—it may not be practical, but it seems to me it is—of keeping this tremendous surplus that is the bugaboo to all of us from going to the cities, paying transportation on so much water and then having to manufacture just the surplus products and dumping the by-products down the sewer.

Those by-products are things we need back in the country, and it seems to me if somehow we can arrange to first only send to the cities such milk as is actually needed for consumptive purposes, manufacture the surplus back in the country, where the by-products can be more intelligently used, and perhaps work out more economical methods of distribution, and together with everybody try to have the heads chopped off of these inefficient producing cows, I think it will be more profit for the farmer and more business for the banker, and in general better circumstances all around. And we believe right to-day the study of economical production and consumption is as big a problem as production. [Applause.]

Chairman MINER. That is good gospel.

Mr. GALLOWAY (of Connecticut). Listening to these various gentlemen brings up two or three thoughts to me. I am a farmer myself, of Connecticut.

First in regard to the chairman's statements about more machinery. I know in my own case I have tried to put in some machinery; and while I found the tractor has saved me a good deal of labor, I found I couldn't sell the horses that stood in the barn. During the winter season in hauling hay and grain from the railway station I have had to use those horses. And when it comes to spreading manure, and so on, I can afford to let the horses stand in the barn.

I suppose on large farms probably different conditions prevail, but for some things machinery is excellent. For others it is no good at all. And on the smaller farms here in the East I don't think we can make as good use of your machinery as you can in the West on your larger areas. In the East farms are rather hilly. The roads are hardly in a condition to put on a motor-drawn machine in good service. There are rocky roads, sandy roads, and places where you would stall the tractor. You would have to have the horses to get to and from the road.

There is another thing I was very glad to have heard, but I think that the average farmer feels about trying to get money from the bank as the average man would feel in going to the back door of his broker to see if he couldn't realize something on his bonds. They would hesitate somewhat about taking loans from the banker except when they really have to do it. And I think it is a most unfortunate feeling to the farmers to feel that way.

But I think a great many of the small country bankers act in just that way regarding the farmer. They don't seem to do any constructive work. I am very glad to have heard these gentlemen this afternoon—some of the bankers in the country are waking up, and I believe if more of them will wake up it will make a big difference in agriculture in the Eastern States where the farms are small and the farmers as a rule deal with small capital. I think it differs somewhat with the larger areas in the West, where there is more capital invested, and I believe that the man with a larger capital invested has had better opportunities for education and development. It is not the case with the back-country farmer in the East.

Chairman MINER. Any further discussion?

Mr. C. H. WILLOUGHBY. I would like to report for the Southeastern States that practically all of the bankers' associations can very quickly adopt the methods outlined by our friend from Grove City in financing not only the older farmers but the young farmers in securing the right sort of cattle. As you know, we have a scarcity of the better sort of cows in the South, and in some locations they have sent a competent expert to the northern States to select cows by the carloads and bring them to their home States and distribute them there.

I recall one case on the east coast of Florida where a carload was distributed to the club boys there. Very little of that money was paid in cash. The banks carried the notes, and for the benefit of the bankers who may discuss this plan I believe that in every case those loans have been repaid. I am certain such is the case in the State of Florida. I think they have never lost a dollar on such loans. And thereby they encourage the boys to become customers of the banks and the boys are well satisfied. So in this way we hope to continue that work even more from year to year.

The Bankers' Association of Florida has even offered scholarships to deserving boys who can pass examinations to the State university for a year's course of study there after demonstrating their fitness. There are many ways, then, by which the bankers through their individual work or State associations may help this promotion of better livestock in the industry.

While I am on my feet, if you will permit me to hark back to the paper about dairy and factory management, I will give a thought there that might be of use to some members.

It was suggested by Director Peter, of Switzerland, that there is great need for training of young men for factory management, and there is a considerable lack of the right sort of training for these young men who wish to go into that sort of work. Many of the dairy schools are not properly equipped to train young men to be successful as soon as they should after completing their courses of study.

In Florida we have secured the cooperation of some of the large commercial dairy concerns. The large ice-cream factories and large milk companies in the cities have agreed to take our students either during the vacation period in the summer or at times in the year when they could be spared from their school work, and train them in their factories for the actual work of managing or watching the management of this work in large volume, much larger than they could get at college.

At the University of Cincinnati, as many of you already know, there is a plan for part-time work of students, especially in engineering, where the students two or three days of the week work in a machine shop and the remaining days of the week pursue their study or work in the university. In cities where a large dairy factory is located it seems to me possible that such a plan would be entirely feasible to train our young men better for dairy and factory management work. I would like to hear that discussed by Professor Irving, if he would. So in that way we hope to make our agricultural college students more useful to the business organizations.

Chairman MINER. I am sure it is a matter of satisfaction to all of those interested in industry in the North to see the interest that is exhibited in the Southeastern States, and for the benefit of the last speaker I will call his attention to the report of the president of the Southern Railway, where after a long excursion into finance and construction and the like, he refers with a great deal of satisfaction to the fact that 11 dairies have been established on the lines of the Southern Railway system in the last year.

Any further discussion, gentlemen?

Mr. Wilkins (of England). It might interest you to know that the British Government has recently suggested a plan under which shorter-term facilities are made available. We find that the banks can not be expected, or haven't been able, to fill the needs of the farmer in buying his seeds and machinery, and the State has stepped in and filled that gap, and if any person is interested to know of this scheme, I should be very happy to get them that information.

Under the act, also, they can get long-term credit, as during the war because of the high prices of everything the farmers made heavy loans, and they are not now in a position to pay off those heavy loans.

Mr. Harshaw. I would like to know if the branch bank system makes it any more difficult for the local farmer to go into one of the branch banks and get a loan than it would be if that bank was owned locally?

Mr. Langford. I think it has to go to headquarters. I didn't think Mr. Wilkins wished to indicate the banks were not generous in giving those, but the State loan is for a different class of person. The banks in our country are generous enough if you have any kind of security to offer. But there has been such a depression among some smaller farmers in particular, and there is a system by which they have been assisted and for the longer terms in order to help the farmers who bought their farms at war prices. And that is pretty much in the same light that you indicated that they pay interest and repayment over a number of years, over 40 years. But so far as the banks are concerned, if they know the man and if his security is what they regard as gilt-edge, there is no difficulty in making any loans.

Chairman Miner. I think I can answer your question as far as one bank is concerned, and that is the Bank of Martins in Liverpool. Two hundred pounds have to go to headquarters.

Mr. Langford. I just want to offer one little criticism. I agree with Mr. Harshaw entirely that the farmers must run their farms as economically as possible, and it has become a very serious question as to whether they ought not to discharge some of their men and try to do the same amount of work with less. That has taken place, obviously; from what the chairman said, you are now using machinery. But I would like to remind the chairman that I think in the Northwestern States 887 people have gone bankrupt within a given period. All but 27 of those eight hundred and eighty and odd were in other industries. The others were all farmers.

My point is—even with this reduced man power and by using more mechanical power, the difficulty to-day is to produce at a sufficiently low cost to be able to sell the article in the market. I understand that wheat in the Northwest costs about $1.40 to produce and it has been sold to-day for $1.

Member from Pennsylvania. I have been much interested in the paper from Grove City. I recall the statement of one of our farmers when plans were made by the Government to finance the farmer.

This man was talking to an intelligent man in the community and he said: " It isn't easy money that we want. It is too easy to get money now from our banks." What he meant to say was that rather than more easy money they wanted intelligent help from the banks about financing.

We found during the year that the farmers who were in trouble following the depression after the war were the men who had been financed by banks and who were young men and made heavy loans at the time of the high prices of all commodities. Those were the farmers who were in trouble. The old-time farmer who ran along on a conservative basis came along all right. He got through.

I can't understand the wheat situation. We heard at Washington the other day—Hoover said that there was more wheat now than the people could possibly consume. The chairman says that wheat can be produced for a very small price.

Chairman MINER. I said it took 10 minutes now to produce a bushel of wheat.

MEMBER FROM PENNSYLVANIA. I was invited a short while ago to go to Washington, and in going from Washington to Chicago I got into conversation on the train with a land man from Manitoba. I told him that I had four sons, and he told me the thing for me to do was to come to Canada and buy land and put those sons on the land. He said they raised wheat up there in great quantities on these farms, used modern methods such as the chairman has touched on. They went out in the spring and put in their crop, harvested it and went back to the cities to live in fine homes during the winter. I couldn't help but contrast that kind of farming with the dairy farmer or the distributor of the milk, if you will, who works 365 days a year.

I don't think if the world is going to produce wheat in quantities beyond what we can consume that any plan of financing can be managed by the Government that will pay a price for that wheat that has probably been arrived at on the attitude that we have grown into by the excessive demands of the war period.

If we produce more milk than we consume, I don't know any method by which we can make the people pay for it that will return the cost of production at a profit. How would we get the money to return it? Fortunately, we are not in that situation with dairy products. The world is short of dairy products and will take them. But I have been listening to our farmers in the Central West telling us for years, or some several years, that the dairy business was going to pieces on account of prices. They told me last year they could not get help enough to raise their corn to make milk. As the summer went on it was proven there was plenty of help there to carry on these farms and make more milk, and the price of milk did go up. The farmers were buying more cows and getting more milk than they ever did.

I think that the question is teaching the farmer to intelligently carry on his farm, as the manufacturer does. He doesn't produce a line that is not going to sell at a cost plus a profit. He knows he can't do that. If he is going on that line he must get his cost out of it.

I think the commission of the banker will be—just as Grove City has gone on to do—to help the farmers to an intelligent understanding of their problem and not lend them easy money to go out and do foolish things with. I have seen committees of farmers come in from our districts in the Central West and try to force upon the cities higher prices for milk without the bankers trying to get them to use their cows intelligently or trying to educate the farmers to use milking machines or reduce their cost or reduce the cost of production of 100 pounds of milk. The only thought of the banker was to get a higher price rather than to reduce the cost of 100 weight of milk.

The banker has a great work in the community to do, but largely in the Central West. We haven't got the Grove City idea there. I hope it will spread our way. [Applause.]

Chairman Miner. It gives me a great deal of pleasure to introduce Dr. L. D. H. Weld, of Chicago, whose paper is entitled: "The meat packer as a distributor of dairy products." [Applause.]

THE MEAT PACKER AS A DISTRIBUTOR OF DAIRY PRODUCTS.

Louis Dwight Harvell Weld, Ph. D., manager, commercial research department, Swift & Co., Chicago, Ill.

In the distribution of perishable foodstuffs the meat packer has come to play an exceedingly important part, both within the United States and in international trade. Having built up the physical equipment and the sales organization necessary for the handling of meats on a large scale and over great distances, the meat packer long ago began to handle butter, eggs, cheese, and poultry. In the distribution of butter and cheese, in which the delegates to this convention are particularly interested, the meat packer has become one of the most important distributors in the country.

Why has the meat packer become so important in this respect, and what advantages, if any, does packer distribution have over other forms of distribution? To treat this subject adequately, and giving our attention primarily to butter, it is worth while to review, first, the conditions under which butter is produced; second, the various methods of marketing butter that have developed; and, third, the part played by the meat packer in marketing butter.

CHANGES IN BUTTER PRODUCTION.

The changes through which butter production has gone during the past half century have had an important influence on the methods of marketing. At first, butter was made on the farm, and it still is to a certain extent to-day. But so far as the commercial product is concerned, farm-made butter has practically given way to that manufactured in creameries.

When the factory or creamery system of butter manufacture began, it was necessary that the whole milk be hauled to the creamery while it was sweet, to be separated at the creamery. This meant that creameries had to be located in sections where milk production was very heavy and that one creamery could take care of only a small territory. This also meant considerable hardship to the farmers who had to haul their milk every day and who lost much time, not only during the hauling but in waiting their turns to unload at the creamery. It was only natural that the factory system should have developed at first in such intensive dairy districts as New York State, northern Illinois, Minnesota, and Wisconsin.

Then came the hand cream separator, which made it possible for the farmer to separate his cream on the farm. This meant that the farmer could carry his cream to market in a can or two, and that he was able to make the trip to the creamery at less frequent intervals. It also meant that the skim milk was retained on the farm for feeding to livestock. Under this system it developed that a creamery could use cream collected over a much wider territory than in the whole-milk creamery.

The hand separator brought about a most important development in butter making. Whereas creameries had been located only in sections that specialized in milk production, it now became possible for creameries to develop in those sections of the country where general farming and grain farming prevailed. This was fortunate both for farmers and for city consumers. In the first place, it opened up a new market for farmers who kept only a few cows as a side line. On the other hand, cities had been growing so rapidly that they were making important inroads in butter sections for their fresh-milk supply. The cheese industry was making inroads into some of the most important dairy sections of the country. And, finally, the demand for condensed and evaporated milk meant the location of condenseries in these same milk-producing regions. If the hand separator had not made practically all farms in the United States a source of butterfat for butter production, butter would certainly have become much more of a luxury than it is to-day.

As a result of these changes, there have developed two distinct types of creameries in the United States. The first is the small local creamery which draws its raw material from a restricted area and to which the farmers haul their cream in their own wagons or trucks. The genuine whole-milk creamery is almost a thing of the past, but the small local creamery plays an important part in butter production, drawing its supply of cream from adjacent territory. It is in this field that cooperative ownership has made such strides.

The other type of creamery is the "centralizer." This is a much larger unit and draws its supplies principally by express shipment over railroads, often from points some distance away. This type of creamery furnishes an invaluable outlet to those great sections of the country which do not raise enough milk to support small local creameries. So we see that there is a field for both the small creamery and the centralizer. In fact, it might be considered that each one is absolutely necessary in its particular field. Needless to say, the packer, in so far as he manufactures butter, falls into the centralizer class.

MARKETING METHODS.

Along with these changes in the methods of butter production there has developed a diversity of marketing methods. Beginning with farm-made butter, a large part of it is consumed on the farm; the surplus is taken to the country store and traded for merchandise, and the country store sells this butter to village consumers. There was formerly a surplus that found its way to distant markets, but farm production has given way to factory production to such an extent that dairy butter is used now only on the farms and in small towns. An increasing number of farmers have given up butter making altogether.

This brings us to the small local creamery, which disposes of its product in a variety of ways. A little of it is sold direct to retail stores, especially since chain stores have come into existence. Some is also sold to jobbers in distant cities, who in turn sell to retail dealers. And a large part is also sold through wholesalers or commission dealers, who in turn sell in large quantities to jobbers, who finally pass it on in small quantities to retailers. The method varies in different cities. In New York, for example, it is very common for this butter to be handled first by wholesale receivers and then by jobbers. In some cases, wholesale receivers in New York sell to jobbers in smaller cities in New England, New York, and New Jersey. In many other cities the local creameries sell to jobbers, who in turn sell direct to retailers.

In the main, it may be said that the typical trade channel for small local creameries is through the wholesale receiver and the jobber. The wholesale receiver sends solicitors out among the creameries and gets them to ship their output to them, guaranteeing a certain definite price, usually based on the New York quotation. The wholesale receiver thus assembles butter of various qualities and in fluctuating quantities, and steadies the flow into the hands of jobbers and retailers. Both the wholesale receiver and the jobber perform necessary functions, but these functions are not so very complicated and their margin of expense is relatively small.

Now we come to the centralizer. Because of his greater volume of business, he is able in many cases to attend to his own selling. In other words, instead of relying on wholesalers and jobbers, he establishes his own distributing houses in the principal consuming markets and sells direct to retail dealers. This is not always the case, by any means. Many of them sell to wholesalers and oftentimes to meat packers, as will be pointed out below. It is not unusual for them, or for other dealers of butter in the Central West, to make sales in eastern markets through brokers. On the whole, the distribution of centralizer butter may be said to be more direct than the distribution of butter made in small local creameries.

THE PART PLAYED BY THE MEAT PACKER.

The fundamental reason why the packer became interested in the distribution of dairy products lies in the fact that he had developed a far-reaching sales organization for the distribution of perishable products, namely, meats. The large meat packer has from the first sold practically his whole meat output direct to retailers, and to accomplish this direct distribution he has had to develop a system of branch distributing houses, located throughout the country. Small points that can not be reached from branch houses are supplied by direct refrigerator-car shipments from plants, filling orders taken by salesmen who make regular trips over specified territories.

The great need in the development of this widespread distributing system has always been volume of business, and hence there has naturally been a desire to handle such products as are adaptable to sale through the distributing organization that had been developed. It was around 1900 that the large packers began in a small way to handle butter, eggs, cheese, and poultry.

The packers had refrigerator cars and refrigerator equipment in their branch houses, so that dairy products were easily added to the products they already handled. Also, they are sold largely to the same class of retailers that handles meats, and consequently the same salesmen could sell them. It was also found that retail dealers were asking the packers to supply them with these perishable products. Deliveries could be made in the same wagons, and bills could be made out by the same accounting force. In other words, the organization for handling these perishable products was already in existence and it was only logical that the packers should begin to handle them. By so doing, the packers made a better economic utilization of their facilities; the added volume tended to decrease unit selling costs both on the meats and on the butter, cheese, and other products handled. A new and more direct market was opened to producers; a new source of supply was made available to consumers.

So far, the packer has been considered only as a distributor, or merchandiser of dairy products. Packers buy large quantities of butter from other manufacturers, but they have also become manufacturers themselves. This is true, for example, of the company which the author of this paper represents. Having found that we could handle butter efficiently, it naturally followed that we wanted to look for a surer and more constant source of supply. We therefore erected what we call produce plants, in such States as Illinois, Iowa, Nebraska, Missouri, and Kansas, as well as other States in the Central West. At most of these produce plants we have butter factories; these same plants collect, candle, and pack eggs; and they also assemble, feed, and pack poultry. There is much of significance to the dairy producer, both in the manner in which these creameries are located and in the fact that they are combined with poultry and egg plants.

As for the location of these creameries, they are scattered about in farming regions where dairying is not a highly specialized occupation, but where it is carried on as a secondary farm enterprise. This is true in general of the States enumerated above. Corn and hog production, as well as cattle feeding, constitute the main farming operations. Although increasing rapidly, dairying and poultry raising are of secondary importance. The density of the dairy cow population is not great enough to justify the establishment of small local creameries or milk condenseries, except in certain unusual sections. There are not enough large cities within easy shipping distance to cause much of a demand for market milk. It is obvious, therefore, that medium-sized creameries, scattered throughout this area, perform an invaluable function in the assembling of butterfat, in the manufacture of butter, and in distribution to distant localities.

These creameries have had an important influence in improving the quality of butter manufactured. They have done all they could to improve the quality of cream shipped by individual farmers, and they have encouraged the thorough cleansing of the cream separator and dairy utensils on the farm. As a result there has been a noticeable improvement in the quality of cream delivered to the creameries. After the cream is received, everything is done to make the best possible quality of butter. The cream is Pasteurized and it is handled throughout in the most approved equipment. Yeast and mold tests are frequently made.

Above all, the matter of thorough sanitation receives principal consideration. Every precaution is taken concerning the construction, equipment, and utensils, as well as in the actual handling of the product. The net result of all these precautions has been, and is, a progressive improvement in the quality of the raw material and in the quality of the finished butter and in its keeping qualities.

Now let us consider the importance of combining these creameries with the handling of eggs and poultry. In the first place, practically all the buttermilk from the creamery part of the plant is used for feeding poultry, thereby converting it into a valuable meat product of fine quality. When the butter volume is light, the volume of poultry handled is heavy, so that overhead expenses are kept at a minimum. Naturally, the same management can look after these various enterprises; the same refrigeration equipment can be used for all products. Even the farmer finds it convenient to market cream and eggs together; he often brings both of these products on a single trip to the produce plant.

Another important feature of these produce houses is the manner in which the goods are marketed. Butter, for example, does not have to be shipped to a wholesale receiver, who in turn may reship it to a jobber in some neighboring city before it finally reaches the retailer. At the packer's produce plant, solid refrigerator carloads of butter, eggs, and poultry are made up and shipped direct to branch distributing houses, from which sale is made direct to retailers by the packer's selling organization. There are no unnecessary handlings, and direct shipment means that these perishable goods are placed in the hands of retailers in the shortest possible time. The whole system is managed from a country-wide and even a world-wide point of view, from headquarters in Chicago, where the needs of the various markets are studied, refrigerator cars are routed, and buying and selling operations are supervised.

Another feature of the distribution of dairy products by meat packers is the extent to which they have branded and advertised the butter they sell. Other butter manufacturers, of course, have also done this in an important way; but the large packers, with their national distributing organizations, are in a particularly good position to do this. The company which the writer represents sells the same brand throughout the country, and in very large volume. All this makes for standardization of quality, lower marketing costs, and a more extensive market for dairy producers.

Though cheese is not made or handled through these so-called produce houses, because they are not located in the cheese-making districts, it may be mentioned in passing that the large packers have become important factors in the distribution of this product for much the same reason that they began to handle butter, eggs, and poultry. The company represented by the author, for example, makes heavy purchases of cheese in the principal cheese districts of Wisconsin and New York. The product is shipped direct in our refrigerator cars to our branch houses in consuming sections throughout the country, where our refrigerator rooms and our sales and delivery organizations are well adapted to the handling of this product.

Enough has been said to show that there have been very good economic reasons for the handling of dairy products by the meat packers. It is not surprising to learn that they have become one of the most important factors of the country in this trade and that their produce plants and selling organizations have become an integral and vital part of the dairy marketing machinery of the United States.

Chairman Miner. I am very glad indeed to present that paper for discussion because I think it is a pretty fair exposition of one of the phases of development in this very rapidly growing industry, and it has occurred to me that there are some questions undoubtedly that have arisen in your minds, as they have in my mind, and one is the question whether in those isolated sections to which you refer there is a cooperation on the part of larger producers, such as yours, with the local monetary powers in an endeavor to further develop the raw material in that section. But that is merely my question when the time comes. I leave it to you gentlemen for discussion.

Mr. Willoughby (of Florida). I would like to ask the speaker if it is the custom of his company to cooperate with local creameries in securing their product and distributing it under the brand name of the company, and if that has been found successful, just how much the company proposes to develop this sort of distribution. Personally, I think it is a very admirable thing.

Dr. Weld. I think there is very little bought from the small local creameries. Most of them market through different channels, through wholesalers and jobbers. We have made some attempt in the past to get some of the local creameries of Wisconsin and Minnesota, for example, to ship to us, and some of them do. But we have never made any very great efforts. We are concerned more with volume business and we buy more from big producers from whom we can buy car lots at a time. We are great on car-lot business.

Mr. Willoughby. Would it not be advisable, however, in those sections where dairying is undeveloped, for example, the southeastern States near my home, for the packers where they find creameries that meet their requirements to purchase from them in quantities sufficient to distribute in that locality? Armour does that.

Dr. Weld. I think we do that to a certain extent, and we would certainly be glad to handle any output of local creameries in that way.

Mr. Willoughby. How much are you willing to develop that sort of thing?

Dr. Weld. I think we have tried to develop that in the South. Just how far we have gone in that I am not sure. I will take that up with our people, though, and see what they are doing and see if they are doing all that they ought to do.

Mr. Willoughby. It would be very helpful to the southeastern dairy industry if the creameries that are now being established in Georgia and Alabama and already established in Tennessee and

South Carolina could secure the help of a distributing agency like Swift & Co. A great saving could be secured in transportation expense.

Dr. Weld. Have they any trouble in marketing their product?

Mr. Willoughby. I think not, because they have good quality, and in many cases southeastern consumers prefer to use the product from creameries that are near their own homes. It is a little fresher, perhaps, but not always.

Chairman Miner. You are looking to the development of the industry in your territory rather than the immediate need.

Mr. Willoughby. Both.

Chairman Miner. Any further discussion of this paper?

Mr. H. L. Brown (of Florida). My visit to creameries in those States, including Tennessee, Mississippi, and Alabama and one or two places in Florida, showed me that they are selling to the different packers; in some places to Swift & Co. I am not sure, but I think the Ashmont Creameries, one of the largest in Georgia, is selling to Swift & Co. And I find it is a matter of bargaining with the different plants. They are using their products.

Chairman Miner. Suppose that is on your car routes and, for instance, you are distributing, we will say, from a section in eastern Kansas into, for instance, that southeastern territory of Georgia and Florida, if the haul is that far. What do you do for return cargo?

Dr. Weld. We can have no return cargo. Most refrigerator cars used in the perishable trade are returned empty. That is unfortunate but necessary for various reasons. First, because there isn't a cargo to take back in perishables. Second, because you can't put nonperishables into refrigerator cars because the dampness hurts the products you put in and is apt to make the car unclean and give a little odor. It is very difficult to get rid of it, although our refrigerator cars are always scalded out with hot water after every trip. That has been gone into and recognized as necessary by the Interstate Commerce Commission that practically all of the refrigerator cars traveling from the West to the East have to travel back empty.

Chairman Miner. Assuming that you were shipping in poultry products from, we will say, eastern Oklahoma to the southeastern United States and these gentlemen were at the same time developing their dairy industry, would you be able to have a back haul on the dairy product you would market?

Dr. Weld. Not to there. It would have to be north of Oklahoma.

Chairman Miner. But you could make a triangular route, the hypotenuse from Florida direct and then back to Chicago. Is that a feasible idea?

Mr. Willoughby. The southeastern territory doesn't expect to have any surplus dairy products to ship to States north of it for a long time.

Dr. Weld. When that time ever comes, it would certainly be feasible to do that.

Mr. Brown. With citrus fruits is that possible?

Dr. Weld. Those cars have to go back empty—most of them.

Chairman Miner. The fact is that the territory east of the Alleghenies and north of the Mason and Dixon line must be supplied from somewhere. The haul is becoming longer and longer every year as far as the West and Northwest are concerned. We are going way out now into territories that a few years ago were undreamed of, and with bulk transportation—milk shipments in tank carloads, just like oil and things of that sort—you are going to be hauling milk from Minnesota and Kansas into New York and Philadelphia in a year or two. You have got to haul in fodder or the manufactured products, and it is easier for you to do that than do the other thing.

Mr. Willoughby. I certainly hope it will open a new field to produce enough surplus milk to bring it to New York City. It is certainly a shorter haul than to Chicago and Minneapolis.

Chairman Miner. Are there any other gentlemen who want to discuss this paper? We are very glad to hear from any of you.

Mr. Harshaw. In feeding buttermilk to poultry, how do you get the buttermilk back? Do you provide for your own hauling from the separator plant?

Dr. Weld. It is mostly shipped in by farmers in the neighborhood who haul their cream in to where the creamery is located. We bring our poultry right to the produce plant and feed it there. We assemble the poultry at the produce plant. The chickens are fed ten days or two weeks on this and various foods, the fat, and so on. We have very extensive feeding plants for our produce.

Chairman Miner. This opens up an interesting subject because it shows you how closely the question of transportation is bound up with the development of this cow-and-milk-belt and distribution as well.

Member. I would like to know if anyone here can give us an insight into the success that is going to follow the shipping of milk west of New York?

Chairman Miner. You have heard the question, gentlemen. It is a rather comprehensive problem geographically.

Mr. C. E. Hough (of Connecticut). The question that occurs to me is as to the need of it.

Chairman Miner. I think there is a consensus of opinion at the moment that the demand is increasing on the Atlantic littoral faster than the territory is able to satisfy that demand. I am speaking now in wholesale fashion.

Secondly, that the territory will hardly, in a general way—I am now speaking broadly of that region north of the Ohio and east of the Allegheny—permit the growth of that roughage that will be sufficient for the full ration. That is a subject, I know, to debate. I am speaking now in a very broad fashion.

Mr. Harshaw. Might I just say that the increase in population in the last five years has been 10 per cent and the increase in the consumption of milk and milk products has been 25 per cent. So you can see how rapidly it is growing.

Mr. Brown. Along that line, it has been brought out by one speaker that it was said by Mr. Hardy, who has made a close study of the milk plants throughout the country, that they are equalizing that milk scarcity by using milk powders, sweet cream, and in some cases unsweetened condensed milk condensed down maybe 1 to 4 and

1 to 3, and then they are using 40 per cent cream. For Florida, for example, they are shipping three solid carloads of 40 per cent cream out of Minnesota during the winter season. That is being used with condensed milk powder made up into a lighter grade cream. Sometimes they use the unsweetened condensed milk that they get on shorter hauls and emulsify it with that in the regular ice cream and make the product out of that. That is being used extensively, and I rather think that will probably be the method of using that from the West.

Chairman MINER. Speaking directly to the question and answering Mr. Hough directly, I call to mind one contract that is in force on the Pennsylvania Railroad. The contract calls for 1,000 cars next year of cream from Chicago to New York in that territory, and those shipments are assembled so that they run sometimes 8 and 12 cars in a train. That is the demand at present. There is a much heavier volume of bulk raw stuff of that sort moving than I had supposed until I got it actually from the leading railway officials in that territory.

Mr. HOUGH (of Connecticut). You do not believe we should import milk from the center of the country to the coast as long as milk is produced nearer the coast?

Chairman MINER. Not the slightest. Mr. Harshaw has just told you of the wide difference in proportion of population increase and demand. If you sat there yesterday in Philadelphia and saw what was going on, you know the value of propaganda and you know what you saw there yesterday was just increasing the demand for that product beyond any ability to estimate the value of x in that equation.

As far as the actual physical handling of the situation is concerned, refrigeration is being developed to an extent now that in some of these cars, I dare say, Mr. Weld's corporation is moving there will be a variation of probably 2° between Chicago and New York. In other words, that product can be refrigerated and put into that car at 46° F. and opened at Chicago at 48° F. I am interested in transportation to a certain extent.

Mr. ALBERT MANNING (of New York). I question whether we should drop this subject at this time leaving encouragement for the immediate future to the southern producer or western producer in supplying this metropolitan district with fluid milk. At the present time the consumer of fluid milk will only consume half of our supply. So we can double our population and still have enough fluid milk produced in this section to supply it. And the eastern producers are only scratching the surface of their opportunities for development.

For the manufacturer of these condensed products there is possible some competition that the eastern producer may meet. The point is whether we want to hold an immediate opportunity for the shipment of fluid milk for long distances, meeting the health requirements which are very rigid in this eastern section.

Chairman MINER. I don't think this is a parochial question. It may be for the present because it is still in the nascent stage. I don't think anybody to-day realizes the change that has taken place in the dairy industry in the last two or three years. When you come to think of the forces that are enlisted now in the forwarding of this industry, when you come to consider that you are capitalizing in the matter of sociological endeavor—all of these child welfare organizations and the like—some day as a result of this tremendous propaganda and meticulous attention to detail that is being practiced in this industry, you are going to see it flare right up like an explosion. It is coming now. It is a matter of arithmetical progression to see where your 25 per cent is going to fall over your 17.

Mr. Hough (of Connecticut) I think Mr. Manning's idea is that we can stand an increase of nearly 100 per cent demand for fluid milk before we will need a quart of fluid milk west of Chicago.

Chairman Miner. Yet to-day there is a very considerable quantity of cream moving east. I don't care to see it. I would rather see men in my own territory getting all that they can out of it than to have it thrown wide open. The fact remains, however, that the time will come when you are going to see that equalized very largely because transportation is going to be the ultimate savior of this industry. It is parochial now.

Mr. Fred Sexauer. Doesn't the very fact that shipments of cream go from the West—and these shipments of cream will gradually displace the shipments of cream from the East—doesn't that very fact point out it is going to be a long time before it is necessary to ship fluid milk from the West to the East, because the cream that is being produced in the East will gradually be produced in the West, because cream is a highly concentrated milk product? Consequently, all the cream that is produced in the East must first be displaced by cream from the West, and that cream that is produced in the East will furnish milk to fill up the volume necessary for consumption in the East. Consequently, I can't see any necessity for a large number of years of shipping fluid milk from the West to the East.

Chairman Miner. If there is any one general idea that has come out of this discussion as far as I am concerned—you haven't had much chance to talk, I'll admit—I believe that the more general distribution, the wider the touch in the interchange of these products the better it is going to be with the industry as a whole.

Dr. Weld. In Chicago, which is the largest livestock center, it seems curious we should ever use meat from Omaha to supply Chicago consumers. But we very often do that. We use the Chicago meat to ship to the Atlantic seaboard for the simple reason we want to take advantage of the shorter haul. We ship through from Omaha to New York, but it takes a day or two longer and we want to have as short a haul as we possibly can. So we use Omaha meat for Chicago and ship Chicago meat to New York.

Chairman Miner. I notice one gentleman whose name is always at the head of dairying in this part of the country, and that is Mr. Greene, of the Pacific slope. Do you want to add anything?

Mr. Sam H. Greene (of California). I came in so late that I fear any remarks I might make might be quite wide of the meat in the coconut.

We have some rather long hauls. We also find the same situation the last speaker referred to. As, for example, in butter. We manufacture in California practically enough butter for our consumption, but we export a considerable quantity, and to make up for that shortage we must take butter from the surrounding States. This situation has come about within the last five years. Previous to that time none of the other Pacific slope States thought of looking to California as a market for any butter which they might have to sell. They now, some of them at any rate, dispose of all their surplus in our California market. The same is quite true in the case of evaporated and condensed milk.

We manufacture, I think, about sixty-odd millions of pounds. I am not quite certain on that point, but somewhere around that figure. I should say that 75 per cent of that product is exported, and we import for use in the State some 30,000,000 pounds instead of taking the 30,000,000 out of that which is made in California. That is about the situation.

In market milk we find that, contrary to what would be logical and economical—namely, the zoning of the area of supply around the cities—our dealers reach out beyond what seems to be a reasonable source of supply and bring milk in from regions as far as 160 miles away, while milk closer to the cities is going into manufactured products at a lower price to the farmer than he would receive if he sold it to the city for fluid milk.

I have a thought in connection with that that I express quite frequently in California, and if I may be permitted I would like this opportunity of getting it "off my chest" here. There is nothing new in it, perhaps, but I do believe that many members of the industry overlook this fact, namely, that all industries, whatever their nature, are fundamentally the same. Fundamentally, they are composed of the same factors—production, transportation, manufacture, and wholesale and retail distribution. Every industry is made up of those five factors. But some industries are rather solidly built up, and all those fundamentals are under pretty good control.

A good example of that is the Standard Oil Co. It owns its own wells. It owns its own pipe lines and many of the tank steamers and tank cars. It owns its own refineries, of course, and its own channels of distribution. It finances itself under one direction for all its activities. It is, therefore, rather easy for an industry that is organized as closely as that to eliminate the economic waste, to regulate irregular practices, and to bring the work of taking that product from the soil and transposing it into forms in which the consumer desires it with the least possible loss.

The dairy industry is a loosely organized one. Yet, it has exactly these five factors as all others have. But we see here that in production we have the dairy farmer who considers himself as an individual capitalist. Transportation for our industry is in the hands of the railroads and steamers and the motor-truck lines. Manufacturing for the great part is in the hands of a group of people who own no farms or no cows. Distribution is more often carried on by agencies whose principal interest is in some other line, and who distribute dairy products merely as an incidental part of their business.

That arrangement causes a very great deal of loss. I don't suppose anyone could estimate the tremendous figures into which that loss would run. Take, for example, a disagreement between milk distributers of a city and the farmers who produce the milk for that city. In a city of 600,000 people they can lose $100,000 a month very easily, merely because the men in the producing end of this chain and those in the distributing end are unable to bring their ideas to a common agreement.

Now, imagine the men in the production part of the Standard Oil Co. getting at loggerheads with the men in the distribution department and causing a loss of $100,000 a month.' I bring that point up merely because I feel, and feel very deeply, that we owe a very great responsibility to the producer and to the public, and we fail to realize that when we get into these discussions and these difficulties. If we realized more fully our necessary inter-relationship and our responsibility to these two groups, we would work together more freely than we do and eliminate, more or less, this very great loss.

Mr. Hough (of Connecticut). I just want to say a word in connection with that very subject. I have seen a striking small example of the waste in the industry that does take place right along. In our own State only a year or two ago I found creameries making butter within 15 miles of some of the best consuming cities, while milk was being imported into the same State from long distances. I call it an economic sin, and any of us in the industry that are so narrow as to see those things going on and intensified are not true to the industry. We should keep those wastes down. I wouldn't like to see Wisconsin milk, as an example, shipped to New York City while they are running condenseries in New York State in great numbers or cheese factories; shipping in the bulky stuff while the same kind of stuff is being concentrated closer to the market. It would look to me like a terrible waste. I think the industry through this Congress is going to learn, at least I hope it is, how to prevent such economic wastes.

As Mr. Greene says, we owe it to the producer and we owe it to the consumer to stop this waste. Much of it can be done by eliminating discord between producer and distributor, as has been suggested.

Chairman Miner. This discussion has profited us in two ways. It has stimulated a good deal of good, honest thinking, which I wish we had time to continue. I have always believed that friction of that sort is good for the individual, and I am sorry we don't get together oftener and have a round-table talk of this sort from different parts of the country.

The next paper on the program is by Mr. Maggs, chairman of directors, United Dairies (Ltd.), England. He was unable to be present; therefore Mr. John F. Phillips, a director of the United Dairies (Ltd.), will read his paper instead. So, with your permission and for our pleasure, I shall introduce Mr. John F. Phillips, of London, director of the United Dairies (Ltd.).

Mr. John F. Phillips (director of the United Dairies Ltd.). Mr. Chairman and gentlemen: I should just like to preface this paper by saying that I am very glad indeed to have this opportunity of being a delegate to this World's Dairy Congress. It has been a revelation to me the way in which the foreign delegates have been received. This is my first visit to this great country, and although I have heard rumors of the warmheartedness of our American cousins, I did not expect such generous hospitality. In fact, I have not yet begun to realize I am away from home.

I am here officially to deputize from my chairman, Mr. Maggs. I don't know whether the chairman would like me to read this paper in full or give the salient points; or if you are still more interested and will come across the pond sometime, I shall be only too happy to return the many kindnesses I have received on this side. [Applause.]

(Mr. Phillips presented the prepared paper on behalf of Mr. Maggs.)

THE ORGANIZATION OF UNITED DAIRIES (LTD.).

J. H. MAGGS, chairman of United Dairies (Ltd.), London.

United Dairies (Ltd.) is the largest British dairy company. As implied by its title, it unites a large number of dairy businesses, most of which, before amalgamation, were competing in the same market so that their services overlapped. It is a "holding" company, for the trading is carried on by about 37 subsidiary companies, the share capital of which United Dairies (Ltd.) owns.

THE FIRST AMALGAMATION.

Founded in 1915, it was originally an amalgamation of the three largest wholesale milk distributing companies in London, including a strong milk products manufacturing side, and a considerable dairy engineering business. The companies comprised were: The Dairy Supply Co. (Ltd.), the oldest London wholesale milk firm, with its auxiliary country milk depots and dairy engineering sections; The Great Western & Metropolitan Dairies (Ltd.), the largest wholesale milk business in London, with its condensery and creameries in Staffordshire; The Wilts United Dairies (Ltd.). In addition to its London wholesale milk business, this included a large condensed milk and creamery business with many creameries in the southwest of England and two in Normandy (France).

The above businesses were themselves the products either of amalgamation or acquisition by purchase of many of the old London businesses, and at the time of the foundation of United Dairies they represented the greater part of the wholesale milk trade in London. The fusion of these interests was undoubtedly hastened by the conditions brought about by the great war, which made it imperative that every possible economy in man and horsepower should be adopted. The principals of the three businesses came together, and with good will and large-minded vision quickly hammered out a scheme under which each business was valued on a common basis. The shareholders of the old companies accepted scrip in the new company in exchange for their old shares, and without going to the public for a penny, United Dairies (Ltd.) was launched with a capital of £1,000,000. The initiator and principal architect of the scheme was the first chairman, Sir Reginald Butler, Bart., who retired owing to ill health in 1922.

RESULTS OF ORGANIZATION.

Shortly after the formation of the new company a large provincial wholesale milk business, that of F. W. Gilbert (Ltd.), Derby, was acquired with several country plants in the Midland counties, Mr. Gilbert coming on the board of United Dairies (Ltd.).

Reorganization was immediately taken in hand. The first step was to divide London into three zones geographically. A managing director from each of the original companies took charge of one zone. Customers were transferred from one company to another so that overlapping services were dispensed with and, although the original three companies' organization remained intact, the number of routes was quickly halved and the number of horses more than halved by distribution being made from the nearest plant. Naturally competitors outside the United Dairies were alarmed, and worked upon the trade and the press with anticombine propaganda. The criticism no doubt served a useful purpose for keeping ever before us the ideal of lifting the milk trade of London to a higher level in every respect. We have undoubtedly proved to the smaller dairyman that the "combine" has been his best friend and gives a service which for efficiency and reliability is far ahead of the best possible in pre-combine days.

TWO OFFICIAL TRIBUTES.

In this connection it may be apropos to quote from the report of "the departmental committee on prices, 1916" (a committee set up by the Government to inquire, among other things, into the prices charged for milk). The report states, "on a general view, the United Dairies (Ltd.) represented an economy in labor and plant, in distribution, much waste of competitive effort being eliminated. It also performed a useful necessary service in supplying the small dairymen who were not in a position to make direct contracts with the farmers for the fluctuating and uncertain quantities of the daily output of farms, with the exact quantity required delivered to their premises at a uniform price, thus relieving these dairymen of the risk of surplus and shortages involved in the system of direct contract."

In 1920, United Dairies was the subject of another inquiry by the subcommittee of the standing committee on trusts. That committee reported that the company "had not dealt unfairly with either the producer or consumer. They have effected considerable economies and we consider that they have operated in the interests of the consumer as well as in the interest of their shareholders."

THE FINAL AMALGAMATION OF THE WHOLESALE MILK SECTION (LONDON).

The process of amalgamation was perfected by degrees, and finally, in 1921 was completed by the formation of the London Wholesale Dairies (Ltd.), a subsidiary company formed to take care of the wholesale milk distribution of United Dairies in London. The organization was concentrated in one office under one managing director. This organization deals daily with about 800,000 pounds of milk, besides cream, all of which is distributed wholesale to private dairies, large institutions, and the larger caterers. This huge volume of milk is now distributed over Greater London, an area of 300 square miles, by means of only 310 horses and 12 electric lorries. The total number of employees, including clerical staff, numbers 443

THE CONVERSION OF SURPLUS MILK.

The shortest road between producer and consumer is the right road for milk to travel, and therefore while by far the largest portion of the supplies is directly consigned from the farm to the London termini, yet in order to insure the fluctuating demands of the public being adequately filled, and the varying surplus being dealt with to the best advantage, it is necessary to maintain a large number of plants in the producing districts. The milk for these plants is usually collected by motor transport, and is either chilled for the liquid-milk trade or converted into various milk products such as cheese, butter, dried milk, etc. As the price of milk in England is to a large extent governed by the fresh milk demand, it will be realized that the conversion of it into goods which have to be sold in competition with the world market is not in itself an economic proposition, but is a necessary adjunct to a fresh-milk business.

SUBSIDIARY BUSINESSES.

This section of the business has by various steps been reorganized and at the present time the creameries, whose function it is to care for the needs of the milk-distributing trade, are amalgamated under the title of United Dairies (Wholesale) (Ltd.). This controls some 40 creameries placed in the best dairying districts of England and Wales.

The manufacture and wholesale distribution of cream and casein is looked after by another subsidiary, trading as Edwards' Creameries (Ltd.).

The condensed-milk business and manufacture of dairy produce, other than hard cheese, is concentrated under the title of the Wilts United Dairies (Ltd.). This also controls the manufacture, import, distribution, and export of fancy provisions, table delicacies, etc.

The dairy engineering side is cared for by a separate company known as the Dairy Supply Co. (Ltd.), with branches in Edinburgh, Cork, and Belfast.

REORGANIZATION OF THE RETAIL TRADE.

In 1917, United Dairies, which up to that time had confined its energies to the wholesale trade, were approached by several of the leading men in the London retail milk trade to formulate a scheme for the retail trade, on the lines which had proved successful for the wholesale. This involved a radical change in policy. Many were skeptical as to the possibilities of combining retail and wholesale. However, these objections were sunk. A scheme was propounded and accepted under which the greater part of the large milk retailing businesses in London transferred their interests to United Dairies, taking the latter's scrip on a common basis of valuation of their respective businesses. The heads of the larger businesses remained to manage, and the reorganization was taken in hand under the direction of United Dairies.

The plan which had proved successful in the wholesale amalgamation was largely followed. London was divided up into a number of zones, one subsidiary company controlling each zone. The managers of these zones being managing directors of their respective subsidiary companies, collectively formed what is called the retail directorate, an advisory body to the main board on retail matters. There are now 14 of these zones covering greater London and delivering milk twice daily to about 500,000 different homes and handling daily over 1,000,000 pounds of milk.

At the end of the first nine months, by the amalgamation of the retail businesses, no less than 736 routes were cut out and 592 horses dispensed with, and from that day to this, as other businesses have been acquired, the good work has gone on.

In 1921 was acquired a considerable business established at Buckingham by Thew, Hooker & Gilbey, manufacturing milk products, particularly malted milk, dried milk, milk chocolate, etc. Our company is always seeking remunerative outlets for surplus milk in the form of milk products, and is now developing what promises to be a considerable business in artificial ivory, the base of which is casein, a by-product of cream.

THE MANAGEMENT.

The scheme of management is, briefly:

The board of directors of United Dairies (Ltd.) is composed of eight managing directors, each of whom is responsible for a separate department. Below the board are various committees which report to the board. The chairman of each committee is a director, but on each committee, except the executive, are co-opted members of the detail directorate and other departmental managers, selected for their special knowledge of the particular subject. These committees are:

The executive committee is practically in constant session. Its function is to give effect to the decisions of the board, to control finance, property, and the head office departments (legal, architectural, engineering, estates, laboratory, etc.).

The milk committee controls the policy of milk buying, farm inspection, and relations with producers' organizations.

The manufacturing committee deals with the policy of the manufacture of milk products, sales, and advertising.

The transport committee deals with all mechanical transport.

The laboratory committee deals with the purity of supplies, efficiency of plants, and controls all laboratories.

The provisions committee deals with the supply of all goods other than milk, for sale in the retail companies' shops, which number 600. This side of the business has been greatly developed and enables distribution costs to be spread over a much greater turnover.

The engineering committee deals with policy of the companies' engineering business and supply of plant equipment to allied companies.

The head office supplies a common organization for the whole of the subsidiary companies in respect of finance, legal, estates, engineering, architects, statistics, transport, and laboratory, but insists on individual responsibility from the managing head of each subsidiary company. The results of each company are separately reported on a common and therefore comparable form.

The volume of business is represented by a turnover of about £20,000,000 per annum, and the quantity of milk dealt with last year was over 1,000,000,000 pounds.

PRODUCER AND DISTRIBUTOR.

In the history of the milk trade the relations between producer and distributor have often been somewhat strained. There have been faults no doubt on both sides. To-day, the National Farmers' Union, which controls the large majority of milk producers in its ranks, has organized the producer, and both sides are alive to the fact that they are both one industry, and that it is to their common advantage that there should be harmony instead of hostility between the two sections.

Last year the chairman of the milk committee of the National Farmers' Union, Mr. Langford, visited the United States and investigated the marketing of milk. Arising out of that visit a scheme was propounded which provides a basis for fixing a price for what is known as manufacturing milk; that is, for the six summer months all milk in excess of 10 per cent above the average production in the four winter months (in October and March the exact average quantity of the four winter months), November, December, January, and February, the price of this "manufacturing" milk being based on the average price of imported cheese month by month. This is undoubtedly a step in the right direction and has enabled the company to reduce the nominal margin between producer and consumer.

It may be mentioned that in one case a farmers' cooperative trading society transferred its business to United Dairies in 1921, on a profit-sharing basis, which appears likely to prove mutually satisfactory.

We are desirous of doing what lies in our power to improve and increase the production of milk, and with this aim have started several young farmers' calf clubs. These have been taken up enthusiastically by the boys and girls and will, I hope, be considerably developed in the future. In this connection, the Daily Mail has fostered the young farmers' club movement, and has been instrumental in starting clubs for pigs, horticulture, etc.

SOCIAL ACTIVITIES.

United Dairies (Ltd.) find employment for over 10,000 persons, and thus have an opportunity of contributing, in some measure, to the social amenities of their lives. This privilege is welcomed, and a social and welfare council has been formed which carries on an increasingly active existence under a devoted and untiring committee formed from members of the staff.

The functions of the council, as laid down in its constitution are:

> To foster and encourage the formation of welfare, sick, holiday, and savings clubs, libraries, literary and debating societies, lectures and classes on business and other subjects, sports, and social activities.

To coordinate and assist existing social and welfare organizations within United Dairies and its subsidiary companies.

To initiate, advise on, and assist proposed social and welfare schemes.

To promote general functions, such as concerts, dramatic performances, carnivals, etc., and to undertake central schemes in connection with any activities within the scope of the council.

To raise and obtain funds and make grants to approved existing and proposed social and welfare organizations.

To formulate welfare and other schemes for submission to the board of directors.

Sports clubs have been formed in various convenient centers, and these clubs meet each other in league competitions and tournaments for shields or cups, given by individual directors, for football, cricket, lawn tennis, golf, hockey, etc.

During the winter arrangements are made for concerts, carnivals, dances, dramatic performances, etc. These functions, whether held centrally or in the several local areas, provide opportunities for "reunion" gatherings of directors, officials, and members of all grades of the staff.

United Dairies dramatic and choral societies have been recently formed and enthusiastically supported, the initial public performance showing great promise and having been thoroughly enjoyed by large audiences.

Although financed in the first place by the company, the various clubs are largely self-supporting, and every care is taken to avoid any element of "patronage" by the company.

In addition to its activities on what may be termed the social side of the work, the council is busily engaged upon schemes connected with welfare. These schemes, which include the provisions of rest homes and the establishment of savings clubs and superannuation, will in due course be submitted to the board of directors for consideration.

A house magazine, known as Our Notebook, is published quarterly, and serves to keep alive the family spirit which we regard as important in our large and widely spread family.

FINANCIAL RESULTS.

As business men you will want to know whether the financial results have been worth while. The following summary of these as shown by the balance sheets of United Dairies tells its own story:

	Issued capital.	Net profit.
To June 30 –1916	£932,902	£66,549
1917	940,155	[1] 104,798
1918	2,331,489	[1] 153,448
1919	2,430,681	[1] 233,444
1920	3,281,336	[2] 279,668
1921	3,451,241	[2] 356,185
1922	3,908,799	452,691

[1] Subject to excess profits duty.

[2] Subject to excess profits duty and corporation profits tax.

There are over 12,000 shareholders to-day who are associated with the company.

EFFECT ON PUBLIC HEALTH.

Not less important, in my view, is the effect of our organization on public health, and I claim for United Dairies no small share in the improved mortality figures. The registrar general in his annual report for 1921, made the following statement:

> The fall in infant mortality attributed to tubercle is so rapid and continuous that the disease is ceasing to be an important contributor to the death rate. This is the third year (United Dairies have been retailing 3½ years) in succession recording a death rate below that of the previous years, and for tubercle as a whole the mortality is now only 30 per cent of that of 15 years ago.

London leads the large cities of the world in the lowness of its infant mortality rate.

The Times last fall drew attention to the fact that the infant mortality rate for the twelfth week in succession during the dreaded third quarter of the year was below 50 and that the Pasteurization of milk, carried out by United Dairies (Ltd.), was an important factor in reducing this rate, for it controls some 65 per cent of the total milk supply of the metropolis.

In London alone, our laboratory examines more than seven times the number of samples of milk and cream that are examined by the public authorities in the whole of England and Wales.

BOTTLE DELIVERY SYSTEM.

The Ministry of Health has recently recognized other standards of milk than butterfat and milk solids, and has propounded standards for certified grade A and Pasteurized milks. These standards necessitate a bottled delivery. All this is in the right direction and we welcome any wise legislation for the betterment of the milk supply.

Chairman MINER. I am very glad indeed that we have been able to have this paper. There is still a sufficient amount of time to be devoted to the discussion of it if you desire. Mr. Phillips announces he will be very glad to answer any questions.

Mr. WILLOUGHBY (of Florida). I would like to ask the speaker what proportion of the milk is being used for the manufacture of ice cream in the cities of Great Britain. In this country we find the making of ice cream one of the most remunerative parts of the industry. I was wondering if that trade was developing in other countries.

Chairman MINER. I think Mr. Phillips will take these questions down and then answer them all in one general discussion.

Mr. PHILLIPS. In regard to the ice cream, we put in a plant about 18 months ago, but in London the ice cream trade at present is practically nil. It is an industry which has to be fostered. There are various reasons why ice cream doesn't sell so readily in London as in America. Some say it is the dry atmosphere. We haven't been very successful at present. We find a seasonable trade for ice cream, but our weather conditions are so varying. We have a run on it for three or four days and then it goes flop. It is a business that has to be created and the demand has to be made, and we are taking a leaf from your book in that respect. We are doing advertising, and if there is anything in it we mean to have it.

Mr. Hough. What percentage of the milk produced in your country is used as fluid milk, and what percentage is manufactured?

Mr. Phillips. As far as the United Dairies are concerned, it is about two-thirds fluid. We handle 12 per cent of the whole milk of the country.

Chairman Miner. Nobody seems to have paid much attention to that statement that was put out here which I thought would bring you all up on your toes, and that is that the infant mortality is less than in any city in the world.

Mr. Greene (of California). The figures quoted, 50 to 100,000, don't substantiate that.

Chairman Miner. I don't question the figures, but I wanted to have them maintained. Any other questions?

Mr. Hough. It might be interesting to note, I believe, that New York City makes the same claim. One must be right.

Mr. Lane (of England). The statement as made, I think, is about right. We have also understood that London has the lowest death rate, and I am sure some of the divisions of London are extraordinarily small; but taking the whole of London.

Mr. Greene (of California). Perhaps they don't figure the mortality on the same basis that it is figured in the United States. By infant mortality, do you mean infants under 1 year of age?

Mr. Phillips. All deaths under 1 year of age.

Mr. Greene. One of the cities in this country which has the lowest rate was 32. I remember the figure, but not the name of the city.

Mr. Phillips. Then we are beaten.

Mr. Greene. And the year before we had a city with 28. I remember that because it attracted my attention that this last year the rate seems to be a little bit higher than the year before.

Member. Did I understand the speaker to say there were 4,500 milk receiving stations in the country?

Mr. Phillips. Forty-three.

Mr. Sexauer. I would like to ask about the volume of milk that these creameries receive per creamery. I appreciate they vary considerably, but the volume of milk that is delivered individually.

Mr. Phillips. From 3,000 to 15,000 gallons a day, imperial gallons.

Chairman Miner. With your permission now, I shall call for the reading of the next paper, "Dairy and factory management," by Prof. A. Peter, of Switzerland. Professor Peter, will you please come forward?

Mr. A. Peter (director, Government Dairy School, Rütti-Zollikofen, Switzerland). I want to ask your pardon because I think English is a language that is not very easy for me to speak, but I will try to speak as distinctly as possible so you can understand me.

DAIRY AND FACTORY MANAGEMENT.

Albin Peter, director of the dairy school, Rütti-Zollikofen, Switzerland.

The chairman of the program committee, Mr. L. A. Rogers, requested me to write a paper on "Factory management."

Every dairyman, whether he be a helper, director, or manager, knows that there are two different directions in which he must develop his knowledge; the first is the technical line, the second is established upon the economical questions of dairy management.

In the dairy literature these two domains have, until now, not been treated separately. Generally, the authors have, with some reason, preferred to write about the application of physics, chemistry, physiology, and bacteriology for the technical development of manufacturing processes.

The questions concerning the application of economical science for producing milk, for turning milk into products, and for the whole trade of milk and products have been treated until now more or less as a side line. Owing to these facts I thought that there was some lack in the dairy literature, and I tried to give a systematic collection and review of economic matters in dairying. A sufficient knowledge of the principal languages, together with the practical knowledge acquired by study trips to different countries, especially to the United States and Canada, allowed me to bring out my book[1] on a sound basis and to relate facts and instances observed under different conditions.

I beg to give here a summary of matters treated in my lectures, hoping this may arouse some interest in the English-speaking world.

The first chapter is titled "Allgemeine Wirtschaftslehre," which may be translated as "General husbandry" or "General economy."

I intend to give my students in this chapter a systematic and exact notion of economics, money and financial questions, banks, plan of management, etc. Then follows a treatise upon the function and application of work and capital as factors in the producing process. The chapter ends with a review of the modern forms of organizations (private enterprises, cooperative systems, pools, etc.).

The main part of my lectures is devoted to dairy husbandry, or more precisely to the questions of management of city dairies, condenseries, creameries, and cheese factories.

In this part a chapter is devoted first to "Production of milk," intending here to give my students the notion of the different conditions on which the producing of milk depends, it is to say climatic, geographic, and general agricultural conditions; then follow the questions of production costs, selling facilities, etc. In a couple of pages I treat "The intensity of milk production"; this means the breeding of high-producing cows, the proper feeding of them, and the establishment of statistical data concerning the quantity of milk produced on a certain acreage.

A later chapter is titled "The milk supply" (Milchversorgung), relating to all questions concerning the supply of the population with fresh milk. Statistics concerning the relative milk consumption in different cities and countries are given. Then follows a treatise upon the different plans used in supplying cities with milk, the systems regulating the quantity to be transported every day to the place of consumption, the systems of sanitary control, and the means applied by the producer's societies and by law to insure a suitable and wholesome milk. A special chapter is devoted to the supply of infant's milk.

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[1] Peter, A. Milchwirtschaftliche Betriebslehre. Published by Paul Parey, Berlin, Germany. Second edition, 1923.

Another chapter deals with with the condensed milk and milk powder industry, relating to the general conditions of this industry, to the different products and to the trade of these products in Europe and America.

The management of butter factories and the butter industry in general is treated in a chapter of 48 pages. I wish to give my students a notion of general extension of the butter industry, the different kinds of butter, to compare the system of producing butter at farms with that at the factories, the advantages and disadvantages of the whole milk and gathered cream system, the questions of yield and of paying for milk and butterfat, the manufacturing costs, the by-products, the butter trade, and the rules and regulations existing in this field.

Lastly, the management of cheese factories and the cheese industry are treated in a similar way.

The different kinds of cheese are enumerated, also the by-products of cheese factories; then follows the comparison of farm cheese making with the system of making cheese at factories. The factory management itself is then treated with special emphasis on the questions of standardizing the fat content in cheese, the way to find a good method of making, and the yield of cheese. I have suggested a new formula to calculate the probable yield of cheese, when the dry matter of milk and cheese have been determined, or closely estimated. The percentage yield of cheese is

$$K=100\times\frac{T-t^2}{t^3}$$

T means per cent of dry matter of the milk in the cheese kettle; t^2 is the quantity of dry matter lost in the whey. This figure must also contain the difference in dry matter occasioned by salting and brushing the cheese. This figure varies according to the kind of cheese. It is, for example, in the case of fat, ropy cheese (Italian grana cheese), 6.6 per cent; in the case of skimmed milk cheese, only 6 per cent. t^3 means the dry matter of the sufficiently ripened cheese. For instance, the yield of Cheddar cheese, by using milk of 12.5 per cent of dry matter may, when the cheese is cured, increase to 65 per cent of dry matter:

$$K=100\times\frac{12.5-6.4}{65}=9.3 \text{ per cent}$$

A table shows the average figures for t^2 and t^3, on account of different kinds of cheese. Finally I have discussed the cheese trade (methods of grading and selling cheese).

My book is thought to be a compendium to my lectures at the dairy school at Rütti and at the Swiss Polytechnicum at Zurich. Of course, a matter like this may not be lectured to everybody. Students must already have a good notion of the dairy science and some practical experience in this domain. Under such conditions it is very interesting and profitable to give and receive lectures on "Dairy and factory management."

In all advanced dairy schools and in the agricultural departments of universities and similar institutions, a special lecture course should be devoted to this subject.

Chairman MINER. The rule of congresses, gentlemen, is that you are to decide if any change in the program is to be made. Will you defer discussion of the paper you have just heard until the next paper can be given you, as the reader seems to be due at another session of this congress as soon as possible. What is your pleasure?

(It was moved that the discussion of the paper delivered by Mr. Peter be deferred until after the reading of the next paper.)

(The motion was seconded and carried.)

INTERPRETER. Professor Porcher asked me to read this paper, because it is written in French, and he asked me to interpret it in English.

Chairman MINER. On your behalf I shall ask the gentleman to extend our thanks to the professor.

(The interpreter expressed the thanks of the audience to Professor Porcher, in French. M. Bovy's prepared paper was then read.)

L'OFFICE INTERNATIONAL DE LAITERIE.

A. COLLARD BOVY, secrétaire-général de la Fédération Internationale de Laiterie, Bruxelles.

Au début de la fondation de la Fédération Internationale de Laiterie, M. Benno Martiny avait proposé de créer de toutes pièces un institut international de laiterie dont la réalisation aurait imposé des charges très considérables que les pays adhérents à la fédération auraient certainement hésité à assumer.

Pour réaliser le programme conçu par M. Benno Martiny, il eût fallu attirer à l'institute des sommités scientifiques qu'on aurait dû rémunérer très largement et disposer de moyens d'investigation très coûteux qui auraient nécessité des ressources beaucoup plus considérables encore que celles qui avaient été prévues.

Bien que l'entreprise fût excellente en elle-même on devait inévitablement reculer devant les difficultés financières et matérielles qu'elle aurait suscitées.

J'ai pensé que le projet de M. Benno Martiny était cependant réalisable, sinon dans toute son ampleur, du moins dans son esprit, en utilisant les ressources éparses dans les divers pays et en leur faisant produire le plus de fruits possible, jusqu'à ce que l'occasion de faire œuvre plus grande et plus complète se présente.

Dans cet ordre d'idées j'ai donc proposé la création d'un office international de laiterie, dont le siège serait à Bruxelles, berceau de la Fédération Internationale de Laiterie.

Les status en ont été longuement discutés et arrêtés par le Bureau Permanent de la Fédération Internationale de Laiterie.

Le principal but de cet office est d'unir, dans une action commune, de fédérer en quelque sorte les laboratoires de recherches et les stations laitières des divers pays représentés au sein de la Fédération Internationale de Laiterie, pour l'étude des problèmes laitiers d'intérêt général. L'office international constituerait le bureau central où se

concentreraient tous les documents, toutes les études, tous les résultats des recherches entreprises.

Comme l'a très bien dit M. le Docteur Orla-Jensen, dans son rapport du Congrès de Berne, une station laitière ne peut entreprendre à elle seule l'étude d'une question quelque peu vaste. C'est dans l'effort commun, dans l'union de toutes les bonnes volontés et dans la distribution du travail entre toutes les stations et tous les laboratoires laitiers, qui seront subsidiés par la fédération, que l'on peut trouver la solution cherchée.

Les stations laitières ne sont pas toutes outillées de la même façon. Les unes possèdent, en annexes, soit des étables (vacherie, porcherie, etc.), soit un éstablissement industriel ou expérimental (laiterie, beurrerie, fromagerie, etc.), soit des champs d'expériences, etc.; les autres sont spécialisés vers d'autres buts, scientifiques, mécaniques, etc.

Réunir en un même endroit toutes les stations expérimentales, les champs d'expériences, les laboratoires de physiologie, de chimie, de pathologie, de bactériologie, etc., ainsi que toutes les autres annexes indispensables à un véritable institut international, aurait présenté des difficultés bien grandes, sinon insurmontables.

Les organismes existants peuvent prêter leur concours pour l'étude des questions sous leurs différents aspects, chacun travaillant à son point de vue spécial, en utilisant les moyens dont il dispose. On arrivera ainsi à des solutions plus complètes et plus rapides.

La question des laboratoires et des recherches scientifiques et expérimentales étant ainsi résolue, l'office international de laiterie comprendra:

1°. Un bureau de documentation où seront réunis et classés: (a) tous les périodiques, livres et travaux concernant la laiterie; (b) les brevets, procédés, méthodes, marques de fabrique, etc., ayant trait à la laiterie; (c) les statistiques concernant le bétail laitier, la production et la consommation du lait, du beurre, des fromages dans les divers pays et leur commerce (exportation et importation); (d) les législations, réglementations et mesures douanières concernant le lait et ses dérivés.

2°. Un musée où l'on réunirait tous les appareils anciens et modernes de laiterie.

Les statistiques, documents et résultats des travaux des stations laitières et des laboratoires de recherches seront publiés dans le bulletin de l'office international de laiterie, qui sera adressé aux pays adhérents.

Il est prévu, dans les statuts, que chaque année les directeurs des stations et laboratoires laitiers se réuniront pour se faire part des résultats de leurs recherches, les discuter et dresser le programme des nouveaux travaux à entreprendre.

La division du travail dans l'étude des questions permettra d'obtenir des solutions rapides. L'étude de différentes questions pourra être entreprise à la fois et les solutions trouvées seront plus sûrement établies puisque les travaux des diverses stations se contrôleront les uns par les autres.

La Fédération Internationale de Laiterie disposera ainsi des lumières non de quelques savants, mais de tous ceux qui voudront bien lui prêter leur concours. Toute compétition sera supprimée entre eux. Chaque pays conservera ses savants, qui continueront à étudier les problèmes l'intéressant spécialement, tout en travaillant en même temps au progrès universel de la laiterie.

Un plus grand intérêt s'attachera ainsi, dans chaque pays, aux travaux de la Fédération Internationale de Laiterie, qui bénéficiera de nouvelles adhésions.

L'état des finances de la plupart des pays n'a pas permis jusqu'à présent de fixer la cotisation qui sera demandée à chacun d'eux. Il est certain que ceux-ci devront être divisés en catégories d'après l'intérêt qu'ils ont dans la question, c'est-à-dire d'après le nombre de vaches laitières qu'ils possèdent. Le Bureau Permanent de la Fédération Internationale de Laiterie s'est réservé la faculté de fixer cette cotisation; il le fera, à n'en pas douter, dans le plus grand esprit d'équité.

Le programme de l'office est très vaste, mais il peut être réalisé par degrés. Tous les pays adhérents à la fédération lui ont donné leur approbation, mais plusieurs ont demandé qu'on s'occupe tout d'abord de réaliser le programme scientifique.

Il est à souhaiter que le Congrès Universel de Laiterie des Etats-Unis donne à la Fédération Internationale de Laiterie la marque de sympathie que celle-ci attend, en adhérant unanimement à l'œuvre qu'elle vient de créer et dont on peut attendre les fruits les meilleurs et les plus abondants.

STATUTS DE L'OFFICE INTERNATIONAL DE LAITERIE.

Art. 1. Il est créé, au sein de la Fédération Internationale de Laiterie, un office international de laiterie dont le siège est à Bruxelles (Belgique).

Art. 2. Cet office international a pour but:

1. D'étudier, avec le concours des stations et laboratoires laitiers des pays affiliés à la Fédération Internationale de Laiterie, les questions et problèmes d'ordre scientifique, technique et alimentaire concernant la laiterie.

2. De réunir (a) toute la documentation scientifique, technique, et législative en matière de laiterie (littérature, brevets, législation, réglementation, etc.); (b) les statistiques de la production et du commerce du lait, du beurre, du fromage et des autres sous-produits du lait, dans tous les pays du monde; (c) les données concernant les diverses races laitières, leur rendement, leur alimentation et les épizooties qui les frappent.

3. De recueillir tous renseignements sur les nouvelles méthodes et machines, les nouveaux instruments et procédés employés en laiterie.

4. De recueillir des données sur le mouvement laitier et celui des associations laitières dans les divers pays.

5. De créer un musée international de laiterie où seront exposés chronologiquement les divers procédés et instruments employés dans les industries laitières et les laboratoires afin de faciliter les études et les recherches de ceux qui veulent travailler au progrès de la laiterie.

6. De publier un bulletin où seront consignés les rapports concernant le développement de la laiterie dans les divers pays, les données statistiques concernant la production et le commerce des produits laitiers, les travaux exécutés, à l'intervention de l'office international, dans les stations laitières affiliées, ainsi que tous les renseignements de nature à intéresser ceux qui s'occupent des questions laitières.

7. De renseigner et documenter les membres de la Fédération Internationale de Laiterie sur toutes les questions laitières.

Art. 3. Pour remplir son but, l'office international de laiterie se met en rapport avec les œuvres nationales et internationales, qui s'occupent de questions similaires dans tous les pays, par l'intermédiaire des comités nationaux.

Art. 4. L'administration de l'office international de laiterie est confiée au comité exécutif de la Fédération Internationale de Laiterie.

Le comité exécutif a, dans ses attributions, la nomination et la révocation du directeur et du personnel de l'office, ainsi que la fixation de leurs émoluments; l'achat des objets et appareils destinés au musée, ainsi que le mobilier pour les divers services.

Il soumet à l'approbation du Bureau Permanent de la Fédération Internationale de Laiterie dans lequel chaque pays affilié est statutairement représenté par un ou plusieurs délégués lors de sa réunion annuelle: (a) Le programme des études et des recherches à entreprendre dans le courant de l'exercice suivant, dressé d'accord avec les directeurs des stations laitières et des laboratoires de recherches qui doivent y collaborer, ainsi que la fixation des sommes à y attribuer; (b) le bilan de l'exercice écoulé, dressé par le trésorier de la fédération; (c) le rapport général annuel sur l'activité de l'office international; (d) le budget de l'exercice suivant.

Art. 5. Le directeur de l'office international de laiterie a la direction de tous les services sous l'autorité du comité exécutif de la Fédération Internationale de Laiterie. Il reçoit toutes les lettres et communications concernant l'office et signe toutes les pièces et toutes les lettres émanant de celui-ci. Il tient le double de ces dernières à la disposition du comité exécutif. Il veille à l'exécution des ordres du comité exécutif et chaque trimestre il lui fait rapport sur l'activité de l'office.

Art. 6. A l'occasion de la tenue d'un congrès international organisé par la Fédération Internationale de Laiterie et chaque fois que le bureau permanent le juge nécessaire, est convoquée une réunion des directeurs des stations laitières qui veulent bien prêter leur concours à l'office international, pour discuter les divers problèmes et questions dont la solùtion est désirable et s'entendre sur les recherches à entreprendre.

Art. 7. La publication des résultats des travaux scientifiques, exécutés à l'intervention de l'office international par les directeurs des stations et des laboratoires laitiers sera faite par l'office international, sous les noms des auteurs, dans son bulletin.

Art. 8. Pour couvrir les frais généraux de l'office international de laiterie (frais d'administration, de direction, de personnel, d'impression du bulletin, du service d'information, d'achat d'objets pour le musée et pour les divers services, de bureau et d'entretien, etc., ainsi que des travaux spéciaux des stations laitières et autres laboratoires de recherches affiliés) chaque pays s'engage à payer une cotisation annuelle dont le montant sera fixé ultérieurement par le Bureau Permanent de la Fédération.

Art. 9. Les fonds de l'office international sont confiés au tresorier de la fédération et déposés en banque. Toute sortie de caisse ne pourra se faire que sur mandat du trésorier contresigné par le président de la fédération. Les cotisations et tous autres paiements doivent être adressés au trésorier de la fédération qui en donne décharge avec la contresignature du président.

[Abstract.]

THE INTERNATIONAL DAIRY INSTITUTE.

A. Collard Bovy, secretary-general, International Dairy Federation. Brussels.

It is proposed to establish an international dairy institute at Brussels, which under the administration of the executive committee of the International Dairy Federation, will act as a sort of clearing house for dairy research work. A bureau of documents will include periodicals, books, proceedings, statistics, legislation, etc., bearing on dairy problems, as well as a museum of ancient and modern dairy equipment. An annual meeting of directors of dairy stations and laboratories, and the publication of a bulletin containing documents and results of research work will make possible more rapid solutions of problems, since different phases can be attacked simultaneously by various laboratories, each scientist working on the problems which are his particular field.

The financial conditions of the various countries participating has made it impossible to fix the amount of financial support to be asked of each country, but it will be apportioned by the permanent bureau of the International Dairy Federation according to the number of

dairy animals in each country. The cooperation of the World's Dairy Congress of the United States in this project is desired. A formal copy of the by-laws is included.

Chairman MINER. I believe it was your decision, gentlemen, that you would return to a discussion of the paper which was first given. What is your pleasure as to the discussion? Will it be in the nature of asking the reader of the paper questions, or will you discuss it yourselves? The chair is open to suggestions now.

Mr. BENZINGER (of Stockholm). I wonder whether it wouldn't be wise, if there is any discussion regarding the paper of Mr. Bovy, to have the discussion while M. Porcher is present.

Dr. ROADHOUSE (of California). I move that M. Bovy's paper be discussed.

(The motion was seconded and carried.)

Chairman MINER. Gentlemen, the paper is before you. The chair will limit the discussion to not exceed five minutes for each speaker.

Mr. BENZINGER (of Stockholm). I had nothing to say. I only thought that as long as M. Porcher was here it would be advisable to discuss M. Bovy's paper.

MEMBER. Would it be a dairy office or just a relay office?

INTERPRETER FOR PROFESSOR PORCHER. It is thought that there should be research laboratories as well as statistical departments and departments of a commercial nature. But several of the countries now united in the International Federation claim that a scientific department must come first; and only if that is successful, then they may carry on and establish the second department, which is the library, which is, of course, necessary for scientific research work. And if this should be a success again, then there would be other departments. That is the idea.

Mr. E. D. WAID (of the Ohio Farm Bureau). Is this an outgrowth of the good work that Switzerland has been carrying on for some time in the gathering of statistics and supposed to be combined with it?

Chairman MINER. That, perhaps, can be answered by the gentleman from Switzerland.

Mr. PETER (of Switzerland). Gentlemen, we are glad to extend the work. I did not think that the international dairy institute would begin this work next year. Professor Laur expects to establish this organization. But I think when an international era comes to life that this statistical work done by Professor Laur will be connected with an international dairy organization.

But I think this dairy institute must be founded. All nations should be members. I know the International Federation, which meets in Brussels, is working on this line, and the Swiss Dairy Office, which is a member of the International Federation. We have had under discussion the foundation of these international institutions, but we do not yet know what position we will take in Rome. We can not found a new international institute when we have already these international organizations. All of these questions are not settled for the Swiss dairy organizations. We are looking to what is to be done here, and then afterwards we will take our action. I hope you will understand me. I thank you. [Applause.]

Mr. Benzinger (of Sweden). I think the question which M. Bovy's paper brings up is a very interesting thing. The only drawback is that at present it seems to me we can not get together the money to do this work. We know only too well that Europe is in a very bad state; even the countries which have not been in the war have been affected by the conditions so much that the Governments will hardly see their way to give them any money for such a work as M. Bovy has thought it would be wise to do.

However, it seems to me that the question would not be, perhaps, good that an international federation would follow the question and take it up again at a moment when we see that we have come to a success. They are better than anyone else able to know when the time has come, and it appears to me these two institutions shall be together at the same place. In sympathizing with the idea to create such an institution some day, I think that the whole question would be best put under way if the Federation Internationale would put it in their lands and bring it up again as soon as possible; and they have in every country some representative through which they might get information as to whether it would be better to wait another year or so. I think Professor Bovy would like it if the persons present would express themselves as to what they think of the idea.

Chairman Miner. I may say we are very fortunate in having another corps of interpreters, so if any of you wish to discuss the subjects in French, Italian, or Spanish, we will be able to translate it for the benefit of English friends.

Dr. F. E. Posthuma (of Holland). We are all expected to speak the American language and we try to do so; and if I use words with which you are not familiar, I hope you will realize I mean no offense at all.

Professor Porcher represents here the French organization; Professor Peter the Swiss, and I, as chairman of the federation in Holland, represent the Dutch branch of the International Dairy Federation. So I think I am entitled to speak a few words.

The decision for the foundation of this international institute has been already taken by the International Federation. But the only difficulty, as mentioned by Mr. Benzinger, is that all the governments are poor. We came home with our decision and we told the different governments that we needed some money, and they answered they had none. For the Netherlands it is not a great question because our organizations are strong enough to pay for themselves. And we mean, moreover, that if we can not have a foundation on a large scale, then we must have a foundation on a smaller scale. The action has been taken, and what we want as representatives of the international dairy organization in Europe is only this—that we be backed up by the American organization. Therefore our secretary has written his paper; therefore Professor Bovy gave you certain information; and therefore I speak at this moment. We want, we need, the help of America for the international dairy institute, and we beg you to give us your assistance.

Mr. Waid (Ohio). In regard to the statistical records I believe they are extending their inquiries to all countries of the world. Are they expecting to combine with that figures regarding consumption and demand? Are you expecting to include demand figures and consumption figures of the world on dairy products soon, or are you now in combination with your production of figures?

Mr. Wilkins (of England). I do not want to add anything to the excellent paper that has been read, but I think one of the chief and first duties of this institute should be to carry on this work, and that seems to me to raise some problems. I would like to ask whether the backers of this scheme have any concrete examples of the type of research which they think should be carried out by this institute?

Chairman Miner. Professor Porcher, will you answer that?

Interpreter (for Professor Porcher). Professor Porcher wants to point out, first, that there is no industry in which the work which has been done may be more useful than in the dairy industry. For instance, Professor Porcher explained that he came to this country in 1919. He was sent by the French Government to study the condition of the dairy industry and the work connected with dairying in general in this country, and he found that many people connected with the dairy industry wanted to know about the scarcity of milk. And that is a branch in which the work done in laboratories might be useful for producing, evaporating, and concentrating the milk.

Professor Bovy hopes that it will be possible with the help of the office to create an international office of dairying to compare the results which have been obtained in different countries. At present there is the International Institute in Rome, but, of course, that institute is not concerned exclusively with dairying, and Professor Bovy hopes that the dairy industry may deem it advisable to have that office just to assemble the results which have been obtained relative to dairy matters.

Mr. Wilkins (of England). Do I understand that the bureau of research is not to be under this scheme for an international dairy office, but was contemplated as the collaboration of the results obtained in various departments on subjects which will affect generally the dairy industry throughout the world?

Interpreter (for Professor Porcher). The intention of the office is to collect everything which concerns dairying, so that everything will be together. That is the intention of the people who want to start that office.

Chairman Miner. I understand, gentlemen, it is your desire to close the discussion on that paper and we will discuss the paper entitled "Dairy and factory management," by A. Peter, director, Government Dairy School, Rütti-Zollikofen, Switzerland.

Interpreter (for Mr. Peter). The speaker said he should have found his place rather in another session than here, but nevertheless he is going to make these few remarks.

He deals with the educational question. He says he misses the fact that the young people are not trained in a systematic way. All those who attend high school are filled with a lot of knowledge but they are not able to apply their knowledge to practical questions. So he would rather see them get more careful training in broad economic questions.

He refers to a book that has been edited lately in this line, and in spite of all the bad times he found it a good seller, and he thinks it is proven by the success of this book that the young men who want to be well equipped in your line should receive a better training in all economic questions.

He says, in closing his remarks, he is glad that he finds this system well developed here in America. The American people seem to treat this question in a more practical way than in all other countries. [Applause.]

INTERPRETER (for Professor Porcher). I want to say that I don't quite agree with his statement on the question as to why the chemists and scientists are not so economically inclined. I suppose it is because a real scientist hasn't time enough to study economics as well as he should.

Mr. PETER (of Switzerland). I will not say that chemists want to be well trained in economic questions, but I say that our students who are working in dairy schools in the practical line want to know something of chemistry. They want to know something about bacteriology. But they also want to know something of economic questions, and that in a systematic way. They can not only read a newspaper to read the economic questions, always in a peculiar line and not in a scientific line; and I think that there are students in the higher dairy schools and in the technical universities who must be familiar with economic questions of our industry. That is what I will say and add to my book.

INTERPRETER (for Professor Porcher). I agree with him absolutely. I misunderstood the main idea he was trying to bring out.

CHAIRMAN MINER. We have completed the list of papers whose authors are present. The remaining papers on the program for this session will be read by title.

(Adjournment.)

(Papers read by title):

COOPERATION AS A FACTOR IN STABILIZING THE MARKET FOR AGRICULTURAL PRODUCTS.

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On every hand artificial selection tends to become more and more important in the social and economic fields of endeavor. Industrial evolution is little more than the gradual replacement or supplementation of the older law or principle of natural selection. In no field of economics is this more evident and important than in agriculture. The industrial progress of a community no longer awaits the development of natural selection and evolution. Industry does not spread to the various points of the United States in response to direct economic laws; the development of agricultural zones and the fulfillment of irrigation projects do not await the slow process of individual endeavor. Communities have become competitive and community effort is more and more dependent upon constructive realization of possibilities through motivating settlement.

A western State develops an irrigation project which is adapted for dairy purposes. Settlers move upon these irrigated lands. At once, several agricultural problems are presented to the State: First, the aid necessary to maintain the dairymen who have previously acquired a footing; second, the necessity of building the economic welfare of those who have settled upon the new lands; third, the necessity of fulfilling the hope of the project by bringing the unoccupied lands under cultivation. A sound economic policy will undoubtedly consider these interests in the order named; otherwise there is little hope of bringing settlers to the unoccupied areas of the project brought under irrigation; likewise, the success of the farmers who have sparsely settled upon the area is largely dependent upon the economies that must come from the occupation of the entire zone. Taxes, road work, markets, cooperation, and finance do not respond readily to thinly populated areas. An economic pause on the part of the State is likely to be fatal to agriculture as a whole and especially to agriculture in a new area. The entire State must bring its resources and power to bear upon the industrial necessity created by the irrigation enterprise. Other States are eternally active, and dependence upon the passive development and growth may submerge the equities and hopes of the settlers. Economists and individualists may deplore the discount placed upon individual endeavor. The fact remains that the new community is dependent upon the economic vigilance necessary to keep step with competitive efforts put forth by other States and communities.

The formation of capital may be dependent upon natural or traditional standards of living which make possible certain margins of saving, but the application of capital to a given industry does not necessarily follow unguided economic competition. Nowhere is this more evident than in the field of agriculture and nowhere has greater change taken place in capital requirements than in this particular field. The modern dairying plant, the cost of acreage, the technique necessary for cultivation, and the preliminary soil investments now rival many other forms of industry. The necessity for large, or at least larger, capital than heretofore, is everywhere apparent. State bankers very often find it necessary to cooperate in order that the necessary capital may be available for the normal economies necessary for a group of farmers located within the State. Natural competitive forces may be so retarded as to jeopardize the interests of the farmers unless that broader vision be kept in mind. Regardless of the danger that may be involved in a cooperative mass movement to advance the necessary capital to a community, the necessity brought about by modern community cooperation remains as a fact and not a theory.

A lack of stability has been introduced into farming through what may be termed " the failure of the farming generation." For hundreds of years generation followed generation in the tilling of the soil; this became a kind of natural selection in which at least one son, by disposition and tradition, inherited the farm and carried on to a very great extent the economies, customs, and experiences of the preceding generation. Although this may have been a force which somewhat retarded the introduction of more progressive methods, nevertheless, great continuity and stability were brought about by this sequence. The boy or the boys of the farm no longer may be depended upon to carry on the cultivation of the parent's farm. This lack of continuity in the farming generation has done much to break the natural stability of the earlier periods. Throughout the entire country, farms are constantly coming into the hands of new men; this constitutes an agricultural problem of the first order. Farming, like every other industry, requires a continuity which is being interrupted by the failure of the present generation.

There was a time in agriculture when very little selection took place relative to products and stock. The entire agricultural régime was based upon a fairly primitive form of natural selection along these lines. During the last few years, and slowly throughout the generations that have preceded, artificial selection has been introduced in order that crops may be larger and better and in order that stock may conform in quality and weight to larger economies. In other words, the science of agriculture, promoted by scores of agricultural groups and governments and institutions, has been rapidly developed during the last few years. From the time of the clover and the turnip in the Middle Ages, when the three-field system revolutionized agriculture, down to the present day, when soil study, seed, and stock selection are important factors, changes have taken place in farming which require the mind of the master farmer. In no phase of agriculture is this more important than in dairying, where modern science has revolutionized the method of handling a modern farm plant.

In the light of the fact that in different communities broad cooperative forces are now thrown around many industries, each State or district faces the competitive necessity of making the farmer's position successful. In no way should such a semipaternalistic attitude be viewed with growing alarm, for every government has become well acquainted with different aids, bounties, tariffs, subsidies, and bonuses for different phases of industry. Aid to the farmers or to the dairymen is no less fundamental than aid to American shipping through subsidy; aid to the agriculturist introduces few new economic aspects as compared to a score of American tariffs. As a matter of fact, aid to the farmer may readily be more justified than support along many other industrial lines. The economic activity of the farmer is primary and basic; the hard work of the agriculturist has gained the sympathy of all people; the supply of the farmer's product has been inelastic, which accounts for wide fluctuation in market prices. It must be remembered that the farmer seldom goes out of business, regardless of the fact that the price for his products may be below the cost of producing them. This means agricultural supply does not readily adjust to changing conditions in demand. The economic position of the farmer is of great importance to society in general, bearing a very important relation to many political and social problems.

There are many lines of cooperation that might be introduced or advanced as helps to the farmer. Producer's credit for agricultural purposes has by no means been completely developed. It is true that this particular kind of credit has been more popularized than any other, yet in the light of changing productive methods this form of agricultural aid will have much to accomplish. Marketing credit has been much less advanced and constitutes the chief credit problem of the farmer at the present time. Throughout the large areas of agriculture, economic necessity has forced the farmer to market his product at a time when the supply has been much too large to maintain a fair price for the product. Until a constructive, intelligent credit system has been created that will permit the farmer to store and hold until such time as the market will absorb the product, agricultural prices will be depressed and destabilized.

It has been estimated that for every dollar spent by the consumer for farm products about 50 cents on the average goes to the farmer, 10 cents for transportation, and 40 cents for the expenses, deterioration, and profits of the middlemen. At first glance wrong conclusions might be drawn from such a broad statement. As a matter of fact, the cause for this situation is to be found in quite a different analysis than might be expected. The 40 cents absorbed by middlemen does not necessarily represent abnormal profits, rather the failure to distribute farm products with economy. Throughout merchandising there are too many men of the wrong kind in business, which results in such a small turnover of business as to make impossible a low unit cost of distribution. If fewer merchandisers of a high type were to handle these products, making possible from two to four times the business of the average concern of to-day, the resulting low unit cost would make possible either a much higher price for the farm product or lower price for the consumer. The entire field of retailing needs careful scrutiny and elimination in order that greater economy may result.

Most agricultural problems may be traced to the fact that the supply of farm products is inelastic. In ordinary industry a market price which falls below the cost of production will very soon close that particular plant, or at least curtail its output. The manufacturer, by reason of cost accounting, is able to check any great difference between cost prices and market values. The farmer, on the one hand, due to the difficulty in arriving at farm product costs, and, on the other, due to the fact that he clings to the farm, continues to produce a supply which has already passed beyond the power of the market to absorb at a fair return to the cultivator. When prices for farm products do not represent a fair return to the farmer we do not find the agricultural population moving from the soil to the city in such numbers as to correct this condition. The farmer continues his work long after it ceases to pay a fair return upon his investment and his labor. As a matter of fact, he remains even though it be necessary to sell the stock, to market some timberland, or to receive a few cents per day for his labor. This inelasticity of supply of agricultural products constitutes one of the chief causes for agricultural depression.

Cooperation among farmers constitutes one of the most constructive steps in this great field of so many problems. Throughout the United States cooperation has faced many disappointments. A careful survey of this endeavor will satisfy the investigator that the future of this work is worthy of the painstaking steps necessary to make it a success. In the beginning it must be appreciated that results are proportionate to the education of the membership constituting the organization; that success is dependent upon a vision and esprit developed within the membership requiring a long period of time; that the final accomplishment is dependent upon forces little different from the kind and progress of any other large business concern. Cooperation in agriculture when approached in this broader appreciation of time and vision has brought about well-defined marketing economies. First, cooperation standardizes the quality of the product, developing brands and good will known throughout the marketing world. If no other result had been accomplished through cooperation than this better standardization of quality, it would have justified most of the cooperative effort attempted. In the second place, cooperation tends to standardize quantity. A cooperative group will naturally become alert as to the acreage planted and the dairying outfits established in a particular region. There will naturally develop the desire and necessity to look ahead in terms of the added product in order that the market may absorb the growth along some agricultural line. The Raisin Growers Association keeps in constant touch with the new acreage commanded. The dairymen of a given locality will naturally be interested in the number of cows added to the total herd. In this way a broad, comprehensive program may be developed without the necessity of such curtailment as will lose the support of the buying public. In the third place, cooperation creates a better spread of the product upon the existing market. Throughout the entire United States experience upon experience has clearly demonstrated the fact that a proper market analysis has not preceded the marketing of merchandise. One of the great opportunities of the cooperative concern is such a detailed study of various markets as will permit the orderly absorption of a given supply. In the fourth place, cooperation in agriculture must eventually develop and expand the market for the product coming within the cooperative endeavor. Cooperative societies are more or less appreciating the value of publicity and advertising as outlets for their product. This broad market vision is the result of years of successful organization and constitutes the aim, and in a sense, the final purpose of a progressive marketing organization.

STATUS OF TRADE ASSOCIATIONS IN THE DAIRY INDUSTRY FROM THE STANDPOINT OF ECONOMICS.

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Economics has to do with the wealth of nations. In what respect, if any, do modern trade associations have to do with or affect those fundamental factors of a nation's growth as studied in the economic field? Do they serve a purpose from the standpoint of a producer, or is their existence purely predatory or parasitic upon the industrial fabric of a nation? In either event, the fact that they are organizations of a nation's business, subjects them to study and analysis from an economic viewpoint.

If the former, they are vitally necessary to progress and will prevail. If the latter, they are an evil encumbrance and will fall of their own weight.

In America, various trade associations have been attacked by legislative and regulatory bodies on the theory that the activities of such organizations have interfered with free and open competition. The lawmaking bodies, therefore, clearly recognize the fact that our trade associations have materially to do with a nation's commercial affairs and that, in functioning, such group organizations must harmonize in their activities with the economic benefits which must naturally flow from a competitive system of industry.

Out of its prototypes, the medieval guilds of England, the kartels of Germany, and the League of the Hansa Towns, the modern trade association has evolved from a union based upon necessity into an organization inspired by the best thought in the field of public service and economic endeavor, whose object is the good of all mankind and whose field is the world.

The history of the guild movement begins with the Norman conquest, which, through its close union of England and Normandy, led to an increase in foreign commerce and stimulated internal trade and industry. With this expansion of trade, the mercantile element soon felt the need of joint action to protect its growing prosperity against encroachments.

The guild was doubtless at first merely a private society, having for its object the protection of its members, the tradesmen of the borough, and the maintenance of the newly invigorated trade interests. During the twelfth century it gradually became a recognized part of the town constitution, thus entering upon its second stage of development. The guild was called into being, not out of antagonism to existing authorities, but as a new institution by which the community controlled its local industries in the interest of the consumer.

Germany seems to be peculiarly the home of trade associations so far as the Continent is concerned. As developments of the early kartels, Liefmann, in 1897, writing regarding trade combinations in Germany, was able to mention those of international scope in 41 different branches of industry. The form of combination in Germany is ordinarily that of mere contracts among independent establishments regulating the amount of output for each and, in certain cases, also the prices. As in Austria and in France, a central selling bureau for all the members of the association is frequently found.

The Hanseatic League of the free towns of Germany seems to have dated from the year 1241. At the height of its power during the fourteenth and fifteenth centuries, it comprised from 60 to 80 cities, which became, at that early period, celebrated alike for the extent of their commerce, the magnificance of their buildings, and the wealth of their citizens.

The idea of protection was paramount in these early associations, hence, we find that, as in the case of the Hanseatic League, they became political powers, exerting a decisive influence upon the destinies of nations. Thus in the early part of the fifteenth century, the Hansa Towns, having espoused the cause of the Count of Holstein, who was at war with Eric X, King of Denmark, sent a fleet of upward of 200 ships, having more than 12,000 troops on board, to the assistance of their ally, deciding the contest in his favor.

The underlying idea of men with mutual interests associating themselves together to their common advantage is extremely old—how old I am not prepared to say—but the Bible contains several references to organizations of goldsmiths, apothecaries, spice merchants; and profane literature, almost as ancient, provides abundant references to organizations based upon similarity of occupation of their members.

The ancient guild may properly be regarded as the legitimate parent of the modern trade association, although there are, of course, wide differences of method and administration. But aside from these technical differences, the essence of the modern trade association as distinguished from the protective guilds and combinations of ancient and medieval times is that the trade association of to-day not only recognizes the need for intelligent and legal cooperation in industry, but has as its object public service in the field of economics in building up the wealth and influence of the nation as well as of its individual members. There is also this distincition between their methods of procedure. The former enforced their rules by regulation and penalty while the latter accomplished the same results through education of the member and the consumer.

The United States, however, so far as size, leads in the number of trade associations and financial resources. Germany, France, and Belgium have the advantage, however, in long use and experience and mature development. The movement is more recent in the British Empire, although there is evidenced an unusual degree of activity in trade association formation. In England alone it is said there are considerably more than 500 trade associations, with a modern tendency for their increase in every important branch of industry. Typical of such associations in the United Kingdom are those of the textile, brass, copper, tin, chemical, electrical, paint, and glass industries.

It is essential at this point to have a clear and comprehensive definition of the modern trade association, and this has been admirably stated at a recent meeting of the American Trade Association Executives:

> A trade association is an organization of producers or distributors of a commodity or service upon a mutual basis for the purpose of promoting the business of their branch of industry and improving their services to the public through the compilation and distribution of information, the establishment of trade standards, and the cooperative handling of problems common to the production or distribution of the commodity or service with which they are concerned.

The United States Chamber of Commerce in a recent report defined a trade association as—

> an association formed in a field of industry or commerce with a membership so representative that all problems pertaining to this field can be adequately presented for common consideration and solution, and with the purpose of developing this field so as to have the enterprises in it conducted with the greatest economy and efficiency.

No trade association has any excuse for existence unless it contributes to the material welfare of its members and renders them an economical service. Of course this proposes the utmost support and cooperation on the part of the members to the policies and activities of officers of the association. Every man owes a part of his time to the industry he represents.

While the activities of trade associations are necessarily many and varied, the following, recently compiled by the Secretary of Commerce, are likely to be found in any such association, any or all of which have to do with the immediate economic welfare of the members:

1. *Industrial research.*—Manufacturing processes improve with understanding gained through actual operation. Industrial research is the study of such operation. The trade association functions with remarkable success in the promotion of scientific industrial research. More and more is the value of scientific research coming to be appreciated, but in many industries there is little hope of exhaustive research by the establishment of moderate-sized units. Therefore, in many trades laboratories are being supported jointly and are making large contributions to reduction of costs in raw materials and processes and in the better adaptation of products to consumer's needs. Industrial research, though not applicable to all industrial groups, will bring gigantic financial return to industry as a whole in its more general application through trade-association activity.

2. *Commercial research.*—Dissemination of market reports and information concerning business conditions and probable future trends; compilations and distribution of vital statistics of the industry, such as number of plants, capital investment, tonnage of shipments, stock on hand, wage scales and schedules; campaigns for eliminating waste, introducing improved methods of production, establishment of standards, cost and accounting methods, vocational education, and similar purposes; engineering.

3. *Market expansion.*—Promotion of the use of the products of the industry and development of new uses.

4. *Legislative.*—The interest of any one industry or trade, to be sound in the ultimate analysis, must be the public interest. In their legislative activities many trade associations have borne this axiom foremost. Greater uniformity as to State laws affecting the public and industry and commerce may be brought about and the views of a trade as a whole can be properly laid before legislative bodies only through association. The demand of legislatures for the views of the different trades upon all sorts of questions of public interest is incessant, and the open preparation and presentation of such matters is far more consonant with proper development of public life than the private lobbying of the few or powerful.

5. *Transportation.*—Business can not be consummated until goods readily find their way to market. The way must be direct and unobstructed. It must be efficient in its operation and economical. To insure all this the individual can not work single-handed. His interests must be pooled with those of others, and the united group then operates for the efficient transportation of the world's commodities. The trade association traffic bureau thus has many, many problems in constant retrospect before it. There are rate matters, classification, car supply, auditing of transportation bills, the study of competitive transportation agencies, and the real force of such competition. The trade association speaks as the voice of industry in transportation problems.

6. *Protective work.*—Gathering and disseminating credit information among members. Mutual fire and liability insurance, sales education, and sales schools for members and employees.

Credit is the vehicle of trade. Without mutual confidence buyer and seller can not transact business. Misdirected credit must be corrected through proper and legal collection procedure. With its particular broad-visioned and unbiased perspective of the business transactions of its own group, the trade association becomes a peculiarly well-fitted agency in these service functions of business conduct. The basis is one of mutual service and return. The trade association becomes a trusted and reliable clearing house for the industry's vital credit and collection information. While it is true that credit information has been used for restraint of trade, this is not its primary or usual purpose and obviously should be prohibited.

Considering the vast sums expended in insurance against risk and loss, it is no more than logical that trade association activity has taken root in this important field. This has not grown, however, so much from a competitive business point of view, but rather as a matter of education and analysis. Items of costs of doing business must be understood, adjusted, and cut to the lowest point commensurate with efficiency and satisfactory accomplishment. Strange to say, there has been little uniformity in State legislation affecting insurance. Here in particular the trade association has been instrumental in the reasoned elimination of waste and unnecessary expense.

7. *Prevention of trade abuses.*—Business has always entailed the strife of competition. It always will and it always should. However, there are rules and principles of fair play that must be regarded in trade relations, and in the development, establishment, and maintenance of these rules the trade association has come to be a potent factor. Take commercial arbitration, standard contract forms and trading rules, trade terminology and nomenclature—each is a direct step toward saner business practice. The stamping out of unfair competition and misrepresentation and the adoption of fair practice principles—codes of ethics—have been real accomplishments of scores of trade associations in the direction of better business.

8. *Simplification and standardization.*—Waste in industry is acknowledged. Its elimination in a vast area of problems can only be accomplished by collective action in a trade. The simplification of dimensions in articles and parts, the establishment of definite grades and qualities, not only reduce the cost of production and the volume of goods required in distribution but they also increase the actual basis of competition. Hundreds of millions of dollars have been saved through the adoption of principles laid down in such programs, not alone to the business groups concerned but to the ultimate consumer. They have brought about lower prices, through attacking directly the costs of raw material, inefficient plant operation, and unnecessary stock maintenance. The very large movement in this direction is to-day the most promising field for reducing the margins between the producer and consumer, but no progress can be made without collective action.

9. *Publicity.*—With the growth of specialization in business contact with the ultimate consumer or purchaser has become more and more complex. Buyer and seller no longer have the personal relationship that prevailed in generations passed. Public relations—publicity and advertising—have become an exact science. Thus each industry, each trade, has its peculiar problems attendant upon mer-

chandising itself or its wares, and just so, each trade association is proving itself the dominating factor in the development of the public relation of its own business group. It may be cooperative advertising or it may be something more complex. Whatever it is, it always needs the scientifically trained and guided hand of the trade association specialist backed by unanimous support of the group in telling its story to the public, who must know the truth, the whole truth, at all time.

10. *Employee relations.*—Perhaps the individual business concern or manager has taken more frequently and at earlier periods the initiative in forward policies of employee relations. Nevertheless, trade association after trade association is now developing the necessary preliminary stages of more equitable and advanced phases of employee relations. In most cases it is largely a matter of research into the tremendous problems involved—selection of personnel, education, welfare work, accident prevention, employment principles, and collective agreements. The associations will recognize that in the years of devotion to improving the processes of production and distribution there has been great oversight of the human factor and its mass relation. Shall it be approached blindly and without preparation and knowledge? Not if the present-day indications of trade association activity have real meaning.

11. *Government relations.*—Whether the attitude of business be to "keep government out of business" or to the contrary, it nevertheless is true that the Government in its manifold activities directly impinges upon commerce and industry at many points. The control of public utilities, the restraint-of-trade acts, the large volume of Government expenditures, all materially affect business, not to mention the legislative problems thrust upon the Government as the result of after-war reorganization. Official trade information, official industrial statistics, official standards, procedure, and practice are being sought by the trades, and the Government is constructively active in cooperation with business to develop these fundamental services.

The following types of associations are frequently mistaken for trade associations:

1. Associations with a membership consisting of business houses engaged in a variety of businesses, as, for instance, an association consisting of manufacturers of miscellaneous commodities not connected with a specific industry.
2. Professional and technical societies consisting of individuals in their technical or professional capacity rather than business units, such as societies of credit men, accountants, sales and advertising managers.
3. Nonmutual associations, in which any surplus of income over expense is neither returned to the members nor used directly or indirectly to increase the service to members.
4. Associations organized for a single purpose or a limited number of purposes, such as associations of manufacturers which are traffic service bureaus.

Associations which are organized as trade associations, but which undertake activities within a limited field only, are not trade associations in the full sense of the term. It is impossible to distinguish between a real trade association and a limited one of this type by definition; the distinction is a matter of fact. If it is the general policy of an association to undertake within its means and power any type of activity which the development and protection of the industry or its members require, it is a real trade association; if it generally gives serious consideration to activities of a certain type only, it is not a real trade association. However, such limited associations usually perform a desirable function from the standpoint of both their members and the public.

Clearly again the purposes of corporations and of trade associations are different. Trade associations complement the corporations. Corporations, or other firms, exist to do business, to capitalize service in business, to manufacture, to sell, to distribute. Trade associations are not "in business." They do not manufacture; generally they do not distribute or sell. Their aim is to facilitate these and other commercial or governmental processes.

From the national point of view it is worth noting that the Government, in the nature of things, must look upon each industry as a single permanent unit. If the Government wishes to do what every Government department often has occasion to do—to deal with one or another industry, to get its views concerning a matter of trade strategy or trade development abroad; to inform it about this or that or to be informed by it—about a matter of trade technique or trade custom, or trade ethics, or trade data—obviously it can not easily interview or correspond with the existing tens of thousands of individual firms comprising the industry.

A century ago, did the occasion ever arise, such a thing would have been simple. But now it is next to impossible. So the trade association meets the need of a link serving as a medium of expression of, and a means of expression to, an industry.

As illustrations of the economical service there may be cited the efficient services rendered by the National Canners' Association, in the protection of their members and the public through their research and inspection department, in the production and distribution of canned foods; the packing industry which has done extended research work through their laboratories; the International Typothetæ, the laundry owners, and numerous other organizations which have developed and established for their industries uniform methods of cost finding; the implement industry, the brick industry, electric light accessories, and numerous others which have cooperated with the Department of Commerce in standardizing and reducing types and dimensions, and the extensive research work of this and a similar kind that is being done by the various national associations within the industry all serve as illustrations of the great economic service that is being rendered to their members and the positions they are assuming in the great economic fabric of the country in which they have been organized.

And here are other industries, stalled because uncertain about matters of policy or nomenclature, and turning at last, through their trade association representative, to the Federal Trade Commission. At the suggestion of the trade association representatives, the Federal Trade Commission asks the industries concerned to meet in Washington to discuss the problem in hand, and the trade in many cases is able to adjust itself to a situation cleared up without any intervention, disturbing and disastrous as it often proves, of the police powers of the Government.

Virtually every alert industry has come to accept the principle that its success turns on reliable and complete trade information or statistics—in a word, commercial intelligence. As well try to run an ocean-going steamship without navigation charts as direct any modern business without guidance. In other words, each industry needs a watchtower to keep its program stabilized.

For the want of such a watchtower service, one corporation of a great industry went on producing blindly through the period of overexpansion following the war; writing off a loss of approximately $30,000,000 as a result. Here is another that also got caught because it did not know that stocks were on hand in America and imported millions of dollars worth of a product that it could not use.

On the other hand, here you find an industry seasonal in nature yet operating without hazard because of its intelligent use of trade information. At first this industry was "either overproducing or broke." Now it knows at any moment not only its own capacity, the existing stocks on hand, but also the current demand for its products in comparison with those of other methods or other years.

Here, then, is the larger view of trade associations, since experience shows that the trade association in the United States, as well as in the countries of Europe, is a link of indispensable kind between the Government and the business public, thereby taking their places as great economic factors in modern business.

Here you find the Department of Agriculture deeming them to be invaluable, and Congress accepting them in the changing scheme of things in which individuals have lost their voice and the new representation rests with organized groups. And here, again, you will find them accomplishing, in cooperation with the Government, the elimination of freak varieties of production and collective wastes in industry which mean a loss of 30 per cent of our national energies.

Particularly has the International Association of Milk Dealers been active with other organizations and the United States Department of Commerce in its program of simplification and standardization of the sanitary pipe and fitting and the glass milk bottle. Other items, also, are on the schedule for similar treatment with a view of increasing the efficiency and economies of milk plant operation.

Here you will find trade associations doing invaluable educational work for their members. For instance, many of them are doing a large service that can be performed in no other way in promoting the establishment of proper methods of cost accounting; for clearly it is to the good of no one for a manufacturer to go on producing at a loss, and adequate statistics can not be gathered in any industry without uniform methods of cost accounting. It has often been well and truly said that a manufacturerer and a dealer need not fear the competition of the man who knows his costs, but, rather, the one who wreaks havoc in an industry—the man who does not know his costs and thinks he can undersell the man who does. In other words, cut-throat competition is more generally the result of a manufacturer, dealer, or producer thinking he is making money when, as a matter of fact, if he really knew his costs, he might be losing money.

The World War gave a great stimulus to trade associations. When it became clear that the war was as much a war of organized economic resources as it was a war of organized fighting men, President Wilson made one of his happiest selections of men and placed Bernard M. Baruch in charge of the War Industries Board, with instructions to mobilize the manufacturing resources of the Nation for the single purpose of winning the war.

Mr. Baruch executed this commission with singular success, and one of the most serviceable devices he used was to deal with a whole industry through the officers of the trade association of that industry. So effective was this method, that, where an industry lacked such an association, Mr. Baruch demanded that one be organized, so that the Government might have an effective channel for immediate communication with its thousands of individuals and might have a central source of information about the productive resources of that industry at any moment.

Thus the trade associations became clearing houses of the facts about stocks of raw materials, work in process, labor employed, manufacturing processes in which waste and duplication might be eliminated, actual and potential output and—of secondary importance then, but of very great importance—costs of production, upon which the Government based the prices it would pay. This information enabled the Government to allocate raw materials and labor to the best advantage, and to buy its supplies at prices, which, though higher than peace-time prices, were arrived at upon a basis of costs and not by guesswork, and were very much lower than the prices originally demanded by the manufacturers.

The manufacturers themselves were vastly enlightened by this experience. Many of them learned for the first time that some of their competitors were using much more effective methods than they, and what those methods were. Many learned for the first time how to figure their own costs of production—what cost accounting really is. And, most revealing of all, they rediscovered the familiar fact that there is another kind of competition than competition in price, namely, that if everybody gets the same sale price for his product, any individual manufacturer can still make more money than his competitor by either increased production or decreased cost of manufacture, or both. An enormous stimulation was given to the continuance, after the war, of the study of cost accounting, of improved processes, of the management of labor, and of the interchange of such information among the members of trade associations.

The larger thought is that America, and the lesson can be applied to the other countries, is entering upon a period in which nature no longer offers a lap overflowing with plenty. Save in the unexplored frontiers of science, our pioneers have for the most part done their work. These, then, are the days of refinement in our processes, if we are to keep our place in the sun; and these are accordingly the days of cooperation.

And when you look at trade associations in that light, you get a larger, more vivid picture—that of industry and commerce accepting their responsibilities along with their privileges, and making from the old equilateral triangle with the Government, the business public and the people a kind of circle of promise intent upon the future prosperity of America and the world.

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THE DAIRY INDUSTRY IN NORWAY. - 69

R. MORK, assistant professor, Norwegian Agricultural College, Aas, Norway.

I. According to various official statements, the milk production in Norway in this century has grown from 885,000,000 kilograms in 1900, and 1,000,000,000 kilograms in 1907 to 1,120,000,000 kilograms in 1915.

This growth is partly due to an increase in the number of dairy cows, which was 685,000 in 1900 and 750,000 in 1915; partly to an increase in the average milk-yield per cow, which was estimated to 1,279 kilograms in 1900 and 1,483 kilograms in 1915.

During the World War the total production diminished till 1918, when the number of cows was 717,000 and the milk yield also considerably reduced compared with 1915.

After the World War the number of cows rapidly grew to its former size, in 1920 about 755,000, but the yield per cow being but 1,455 in this year, the total production of cow's milk was 1,100,000 kilograms and thus did not reach the production in 1915.

In the last two years the production has grown considerably according to the milk receipt at the factories, and must now be considered greater than in 1915.

The production of goat's milk is of great importance, especially in certain districts as the Gudbrandsdal and the western and northern fjord districts, where the Gudbrandsdalsost—a goat's cream whey cheese is produced.

The per capita production of milk was:

	Kilograms.		Kilograms.
1900	400	1915	448
1907	425	1920	418

For comparison the per capita production of milk in some other countries is cited, according to various statistical reports:

	Kilograms.		Kilograms.
Denmark (1914)	1,273	Finland (1910)	464
Switzerland (1914)	777	Norway (1915)	448
Sweden (1912)	640	United States (1917)	392
Netherlands (1912)	541	Germany (1912)	344.

It must be noted that objections have been made about the items previously cited for the production per cow and thus about the total production. The objectors think that these items must be reduced by about 10 per cent. The author's view is that the official statements must be considered the right ones.

II. A great part of the production is consumed on the farms. During the year 1920 it can be calculated that, on the whole, about 500,000,000 kilograms were thus used. This quantity includes about 50,000,000 kilograms which were fed to calves and hogs. The rest, 450,000,000 kilograms, was used for household purposes as milk, butter, and cheese. Probably about 250,000,000 kilograms were consumed in form of milk and 200,000,000 kilograms in form of butter and cheese. The farm population being about 1,000,000, this represents 250 kilograms of milk, 6 kilograms of butter, and 5 kilograms of cheese per person per year.

The rest of the milk production, 600,000,000 kilograms, was sold from the farms partly in form of milk, and partly in form of butter and cheese.

The production for sale of butter and cheese on the farms is considerable. In 1920 it can be estimated at 3,200,000 kilograms of butter and 2,300,000 kilograms of cheese, in the whole representing 113,000,000 kilograms of milk.

The total sale of milk from the farms was thus about 490,000,000 kilograms. From this quantity about 210,000,000 kilograms were sold directly to the consumers and 280,000,000 kilograms were delivered to the factories.

The milk delivered to the factories was disposed of as follows:

	Kilograms.
Sold as milk	154, 000, 000
Butter production	30, 000, 000
Cheese	55, 000, 000
Condensing	32, 000, 000
Other manufacturing purposes	10, 000, 000
Total	281, 000, 000

The disposal of the total milk production for the year 1920 can then be summarized thus:

	Million kilograms.	Per cent.
Consumed as milk	610	55. 5
Butter production	265	24. 1
Cheese	133	12. 1
Condensing, etc	42	3. 8
Fed to calves	50	4. 5
	1,100	100. 0

III. It will be observed that on the whole 230,000,000 kilograms, or 21 per cent, of the total milk production have been used for production of butter and cheese, etc., for sale. Only half of it has been converted in the factories; the other half on the farms. In addition to this, about 200,000,000 kilograms of milk have been made into butter and cheese on the farms for home consumption.

It is obvious that this is unsatisfactory, as the farm production can not render so great a yield, nor such fine products, and especially not as high prices as factory production can afford. As to the production for farm consumption it can be discussed whether it will be worth while to collect the milk used thus for factories; but as to the production on farms of butter and cheese for sale, there is no doubt that factory production is the only right one.

The state department of agriculture has been aware of this and has since 1850 tried to help in various ways. The milk production in 1907 amounted to about 50 per cent of the value of the whole agricultural output, and the organization of butter and cheese factories has accordingly been one of the most urgent of marketing problems.

The total number of factories and the total receipt of milk in factories were for the following years:

Year.	Factories.	Kilograms of milk.
1890	307	77,000,000
1900	845	184,000,000
1910	738	278,000,000
1915	694	305,000,000
1920	552	281,000,000

The greater part of the factories are cooperative organizations—in 1920, 85 per cent. The first cooperative cheese factory was organized in 1856.

It will easily be understood that since the organization of factories has not developed further—in the factories only 281,000,000 kilograms, or 25 per cent, are handled—there must have been special difficulties.

The essential cause of the delay in developing the dairy industry has been the transportation difficulties, which again are greatly due to the long distances and the scattered population. Norway has only 2,600,000 population, but its land area is 310,000 square kilometers.

On account of this it has been difficult in many districts, especially in the fjord districts of western and northern Norway, and also in the valleys of eastern Norway, to obtain factories of sufficient size. During the last years the transportation facilities have been considerably developed. In the fjord districts the use of motor boats has made the collection of great milk quantities possible, and in the central parts new railways have been built.

On the other hand, there is no doubt that failures and mistakes have been made during organization and that these have a considerable part in the delay. The items previously given of the number of factories in the years after 1890 show that the number grew very fast in the nineties and reached its highest point in 1900. The factories existing in 1890 were almost altogether cheese factories, but those organized in the nineties were butter factories of the Danish type. Most of these, however, failed within a few years, and now we have only 42 left. The decrease of the factories in the table mentioned is wholly due to butter factories.

We have in this an example of the fact that great precaution must be taken in transmitting a system of production from one country to another. In many other respects dairymen may learn from each other, but each country must develop for itself from out its own natural and economic conditions, the organizations for production and trade.

While the number of butter factories thus decreased rapidly in the years after 1900, the total milk receipt increased from 184,000,000 kilograms in 1900 to 305,000,000 kilograms in 1915. This increase is on the part of the cheese factories and the city milk plants. Both these types have developed along sound lines, new factories have been organized, and the old ones have increased in capacity.

Time has thus given an unquestionable answer in favor of the cheese production and in disfavor of the butter production, and we are now approaching a rapid growth in the organization of new factories wherein the cheese factory line will be followed.

On the whole, much has to be done to give the milk producers opportunities for disposing of their milk in an economic way. Among the dairy problems of to-day this is by far the most important.

IV. The demand for fresh milk has always been satisfied except in some months in the fall of 1918. It is supposed that the consumption of milk is about 200 kilograms per capita per year for the town inhabitants and 250 kilograms for the country population.

The demand for butter has been satisfied during the years from 1895 to 1917, and there has also been a small export to England. Since the war, the imports have exceeded the exports by about 3,500,000 kilograms a year. The per capita consumption of the nonagricultural population was in 1920 estimated at 5.0 kilograms per year, consisting of—

	Kilograms.
Factory butter	1, 150, 000
Farm butter	3, 200, 000
Imported butter	3, 670, 000
Total	8, 020, 000

The demand for cheese has also almost always been supplied, but since the war the imports have exceeded the demand. It must be noted that in Norway a great part of the cheese consumed is whey cheese. The per capita consumption of the nonagricultural population in 1920 was estimated at 8.0 kilograms a year, consisting of—

	Kilograms.
Fat cheese produced in factories	4, 460, 000
Skim-milk cheese produced in factories	2, 430, 000
Whey cheese produced in factories	4, 200, 000
Cheese produced on farms	2, 300, 000
Imported	1, 430, 000
Total	14, 820, 000

The items given represent the nonagricultural population of 1,600,000. The consumption of the farm population was previously cited.

The condensed and dried milk production is for the greater part exported.

V. The war has changed the export balance considerably. Before the war, Norway had a net export which, on the whole, represented about 80,000,000 kilograms of milk. These last three years the net import has been equally great.

The total production of milk now being as great or perhaps greater than before the war, the chief cause of this change in the import balance is the rapid growth in population, which, in turn, is caused by the checked emigration. But it is also beyond doubt that the per capita consumption of milk and dairy products has grown a little.

The production is undoubtedly great enough to satisfy the different wants. But, as already said, it is necessary to organize factories in the districts where such have been dismissed, and when this is done the factory production will suffice for home consumption and exports, probably of cheese, as the natural conditions are excellent for cheese making.

SUMMARY.

The total production of cow's milk in Norway is estimated to have been in—

	Kilograms.		Kilograms.
1900	885, 000, 000	1915	1, 120, 000, 000
1907	1, 000, 000,000	1920	1, 100, 000, 000

The milk production was disposed of thus in 1920:

	Kilograms.	Per cent.
Consumed as milk	610,000,000	55.5
Butter production	265,000,000	24.1
Cheese	133,000,000	12.1
Condensing, etc	42,000,000	3.8
Fed to calves, etc	50,000,000	4.5
Total	1,100,000,000	100.0

The total number of butter and cheese factories, milk plants and condenseries and the total receipt of milk in factories were:

Year.	Factories.	Kilograms of milk.
1890	307	77,000,000
1900	845	184,000,000
1910	738	278,000,000
1915	694	305,000,000
1920	552	281,000,000

The milk production has in the years between 1895 and 1917 been great enough to satisfy the domestic demand for milk and milk products. After the World War the imports have exceeded the exports by about 3,500,000 kilograms. It is assumed that within a few years the production will suffice for maintaining an export especially of cheese.

ORGANISATION INTERNATIONALE POUR L'UTILISATION DU LAIT.

Ernst Laur, Ph. D., directeur de l'Union Suisse, des Paysans, Broug, Switzerland.

Si, d'une part, le prix du lait est influencé dans chaque région de façon tres sensible par ceux qu'obtiennent le beurre, le fromage et le lait condensé, sa formation dépend, de l'autre, depuis que les produits laitiers s'expédient d'un point quelconque du globe à l'autre, dans une très large mesure de l'allure du marché mondial. Aussi n'est-ce plus guère que dans les régions dans lesquelles la production parvient à peine à faire face à l'approvisionnement de la population en lait de consommation que la formation du prix du lait est conditionnée avant tout par le marché local.

Le commerce du beurre et du fromage fait l'objet d'une organisation internationale et la production du lait condensé est concentrée entre les mains d'un petit nombre de maisons qui étendent leurs ramifications dans le monde entier. Or, tandis que le commerce des produits laitiers représente une véritable puissance, il n'existe pas jusqu'à ce jour en face d'elle d'organisations internationales des producteurs. Divers pays possèdent, à vrai dire, de fortes associations de producteurs de lait, mais toutes agissent indépendamment les unes des autres et elles n'ont entre elles aucun lien commun.

L'office de renseignements sur les prix de l'Union Suisse des Paysans, toutefois, a organisé, il y a une quinzaine d'années, un service d'information sur le marché international des laits et des produits laitiers. Ce service d'information, qui n'a aucun caractère officiel, fonctionne grâce à la collaboration d'offices et d'organisations agricoles des pays ci-après: Allemagne, Autriche, Argentine, Australie, Belgique, Brésil, Bulgarie, Hongrie, Italie, Jougoslavie, Norvège, Pologne, Roumanie, Suède, Suisse, et Tchécoslovaquie.

L'office précité fonde ses enquêtes, d'une part, sur les questionnaires qu'il envoie aux offices correspondants des différents pays; de l'autre, sur les informations qu'il emprunte à la presse commerciale et agricole des divers Etats. Il publie régulièrement la documentation ainsi recueillie dans des rapports trimestriels contenant de nombreuses indications numériques et comprenant les chapitres ci-après:

1. La situation économique mondial (bref aperçu de la situation commerciale et financière, du marché, du travail, etc.).
2. Récoltes fourragères; prix des fourrages secs et des denrées fouragères.
3. Importance de la production laitière dans les principaux pays laitiers; apports de beurre et de fromage aux places commerciales les plus importantes.
4. Mouvement des prix du lait dans les principaux pays laitiers.
5. Mouvement des prix du fromage.
6. Mouvement des prix du beurre.
7. Le mouvement probable des prix au cours des mois suivants.
8. Conclusion (brève récapitulation de la situation du marché des laits et des produits laitiers).

L'office de renseignements sur les prix a publié jusqu'à présent 57 de ces rapports. Ils paraissent chaque fois en allemand et en français et, sous forme d'extraits, en italien et en anglais. Les frais de ces enquêtes sont supportés par l'Union Suisse des Paysans.

Cette organisation suisse est un embryon susceptible d'un large développement et nous recommandons l'étude de ce problème aux organisations d'agriculture et d'industrie laitière de tous les pays. Nous prenons la liberté, dans le but d'en faciliter la solution, de présenter les propositions qui suivent:

1. Développement du service d'information sur le marché international des laits et des produits laitiers organisé par l'office de renseignements sur les prix de l'Union Suisse des Paysans:

(*a*) En accroissant le nombre des correspondants et en accélérant le service d'information;

(*b*) En développant les enquêtes d'ordre statisque relatives à la production et aux prix;

(*c*) Par la traduction des rapports en anglais et éventuellement dans d'autres langues;

(*d*) Par l'échange entre les différents pays de la presse commerciale et agricole ainsi que des publications d'industrie laitière;

(*e*) En faisent participer aux frais les organisations intéressées de tous les pays.

2. Constitution d'une commission internationale des producteurs (non pas des acheteurs) de lait qui se réunirait une ou deux fois par an et à laquelle incomberaient les tâches suivantes:

(*a*) Examen de la situation du marché.

(*b*) Fixation de prix normes pour les vendeurs.

(*c*) Régularisation de l'offre de lait et de produits laitiers aux fins d'assurer un prix proportionné aux frais de production. On atteindrait cet objectif par les moyens suivants: (1) La commission donnerait les conseils nécessaires et prendrait les décisions voulues en vue de la régularisation de la production laitière (accroissement ou réduction des troupeaux et utilisation plus ou moins intensive des fourrages concentrés); (2) elle donnerait les conseils nécessaires et prendrait les décisions voulues au sujet de l'importance à donner aux divers modes d'utilisation du lait; (3) elle s'attacherait, par une propagande appropriée et tous autres moyens, à stimuler la consommation du lait et des produits laitiers; (4) elle prendrait l'initiative de démarches tendant à la création d'organisations d'achat et de vente de lait et produits laitiers, éventuellement de concert avec le commerce.

(*d*) Les membres de la commission seraient nommés par les diverses associations nationales de producteurs. Chaque association pourrait déléguer un nombre de représentants égal à celui des unités de cotisation qu'elle souscrirait. Dans les votations, cependant, aucun Etat ne pourrait disposer de plus du sixième de la totalité des suffrages. La cotisation annuelle serait fixée par la commission. Elle s'élèverait la première année à $200 par délégué et par an. La cotisation pourrait être réduites pour les pays à change avarié, mais ils ne pourraient avoir droit à plus de deux délégués. L'expédition des affaires courantes serait confiée à une ou à l'ensemble des organisations affiliées d'un pays déterminé.

[Abstract.]

INTERNATIONAL ORGANIZATION FOR THE UTILIZATION OF MILK.

ERNST LAUR, Ph. D., director, Swiss Farmers' Union, Broug, Switzerland.

The price of milk is strongly influenced by the prices of butter, cheese, and condensed milk. At the present time these are commodities of international commerce, consequently, the price of milk

is influenced by the trend of the world market. The commerce, and partially the production, of milk products is internationally organized and for that reason the international participation of the producers is nil or else very slight. That is why, among other causes, the price of milk in many countries does not cover the costs of production.

However, there has been an information service for the international markets of milk and milk products operating in Switzerland for the past 15 years; this service was organized by the office of price investigations from the Swiss Farmers' Union. Fifty-seven reports have appeared thus far, published quarterly in French and German, besides an abstract in English and Italian. The Swiss Farmers' Union has borne all the expense. It is earnestly desired that the agricultural organizations in all countries producing dairy products will lend their moral and financial support to the projection of this work.

Likewise, the milk producers should also create an organization that at the same time would permit an active exchange of views on all that is of interest concerning the international marketing of milk and milk products. This organization should be independent of the buyers and consumers. We propose the foundation of an international commission which will convene once or twice a year and will give instructions on the fixation of the price of milk as well as information on the amount and kind of production of milk, and dairy products.

The commission would have as its special duties:

(*a*) A review and examination of the market conditions.

(*b*) The fixation of a reasonable price for retailing milk.

(*c*) Influencing the supply of milk in order to assure a price proportionate to the costs of production.

This object is to be attained in the following ways:

(1) By advice and decisions concerning the influence on the amount of milk production due to the increase or decrease of stock raising or the extensive or sparing use of forage concentrates.

(2) By advice and decisions as to the greater or lesser advantages obtained from the various methods of utilizing milk.

(3) By giving out information and propaganda to stimulate the use of milk and milk products.

(4) By bringing about the creation of an international wholesale and retail organization for handling milk and milk products, also in conjunction with the trade.

(*d*) The members of the commission to be named by the milk producers associations in the various countries.

Each association is entitled to send as many delegates as it has proportionate stock subscriptions. However, in the voting no single country can have more than one-sixth of the total number of votes cast. The annual assessment will be determined by the commission. Shares for the first year will be fixed at $200 each. The assessment in countries with greatly depreciated currency may be reduced but at the same time the voting right of said country is reduced to a maximum of two. The conduct of current business will be intrusted to a single organization or to all the associated organizations of one country.

SESSION 7. CHEESE PROBLEMS.

Honorary chairman, Dr. Robert Burri, director of the Swiss Dairy and Bacteriological Research Station, Liebefeld, Bern, Switzerland.

Chairman, J. L. Sammis, associate professor of dairy husbandry, University of Wisconsin, and secretary, National Cheese Association.

Secretary, H. B. Ellenberger, professor of animal and dairy husbandry, University of Vermont.

First Baptist Church Assembly Hall,
Syracuse, N. Y., Friday, October 5, 1923—1.30 p. m.

Chairman Sammis. The meeting will please come to order.

Is the honorary chairman, Dr. Robert Burri, director, Liebefeld Experiment Station, Bern, Switzerland, present? If he is, will he please come to the front of the room.

Our recorder is not present at this time, and Dr. J. M. Sherman will act as recorder for this session.

There are a number of papers on the program for this meeting and I think we will begin by calling the roll to ascertain how many of the speakers are present.

(Chairman Sammis called the roll and the following speakers were present: Mr. S. K. Robinson, Dr. J. M. Sherman, Mr. K. J. Matheson, Dr. G. Koestler.)

Chairman Sammis. We will go ahead with those that are present.

The first on the program is the paper on "The relation of ensilage to cheese making," by Dr. Robert Burri, of Switzerland, but as he is not here that paper will be transferred to the end of the list.

Before going to the next subject I want to announce a few of the rules governing this session.

As a general rule, the speaker must be limited to 20 minutes. Discussion will take place at the end of the paper, and it is requested that a speaker be not interrupted until he has finished with the paper, at which time there may be about 10 minutes for discussion. If the discussion is more prolonged it will be postponed until the end of the program. Speakers in discussion are limited to 5 minutes. The secretary will read any papers presented in absentia.

We will now hear from Mr. Robinson on "The Pasteurization of cheese." Mr. Robinson is the chief chemist of J. L. Kraft and Bros. Co.

THE PASTEURIZATION OF CHEESE.

S. K. Robinson, chief chemist, J. L. Kraft & Bros. Co., Chicago, Ill.

This paper considers only the reheating of commercial cheese up to Pasteurization temperature. It does not concern itself with the Pasteurization of milk prior to the manufacture of the cheese. This industry gained considerable importance in the last three years through the advent of loaf cheese. Pasteurizing the cheese just before it is ready for consumption is probably the best method of solving the Pasteurization problem of this dairy product. The benefits of Pasteurizing at that time are obvious.

As we all know, bacterial development is essential for cheese ripening. Where milk is Pasteurized before the cheese is made, the bacterial development follows the Pasteurization, thus allowing for the development of any harmful organisms that may contaminate the cheese during this period. In other words, there is a long period, which may vary from one month to a year, during which time bacteria develop in the cheese. The consumer does not derive the entire benefit from such a Pasteurization. The case is different when the cheese is allowed to ripen naturally and the Pasteurization is carried out directly on the cheese which is immediately sold to the consumer.

By this method of directly Pasteurizing the cheese it is possible to blend so as to obtain a product of more uniform flavor and texture. The manufacturer of Pasteurized cheese can also obtain an article that is much better adapted for market purposes because the keeping qualities of the product have been considerably lengthened. A few examples of this will be sufficient to demonstrate this point. Incubation tests have been carried out on Pasteurized and un-Pasteurized cheese.

This was done as follows. Ten daisy cheeses were taken and small blocks cut about 3 inches wide, 3 inches high, and 12 inches long. These were wrapped in tinfoil, placed in wooden boxes, and covers nailed on. The remainder of the cheese was cleaned and Pasteurized at 145° F., then run into smaller boxes lined with foil to prevent outside contamination. The 20 boxes were placed in an incubator at 37° C. At the end of 20 days, these boxes were examined. All of the un-Pasteurized cheese, excluding one, were swelled and spongy in texture; the Pasteurized cheese were all in perfect condition, with firm body.

The direct Pasteurization of cheese will also be a great step by way of centralizing the cheese industry. The conditions prevalent in the State of Wisconsin to-day, where cheese is manufactured in 2,700 separate factories, are not conducive to the development of a uniform product, whereas a few Pasteurizing factories properly located in such an area could blend the cheese obtained from a large number of these smaller factories and so standardize this product to a great degree. Anyone familiar with the cheese industry knows that lack of uniformity is one of the main reasons why we have so much difficulty in increasing the consumption of cheese in the United States.

METHODS OF PREPARATION.

There are different methods of preparation in use in the United States to-day. Essentially it consists of grinding the cheese, heating in a jacketed container with agitation, and filling into the proper containers, either directly or with specially designed machinery.

CHEMICAL AND PHYSICAL PRINCIPLES INVOLVED.

During this reheating process conditions are favorable for emulsification. Approximately 38 per cent water, 33 per cent butterfat, and large amounts of colloid material in the form of casein and small amounts of albumen are present. The casein is ordinarily very slightly soluble in water, but in the presence of Na and NH_4 salts it becomes soluble and would therefore promote an emulsion in which the water would be the continuous phase. The plasticity of the casein is most important because it acts as the cementing agent for all the other ingredients. Not all casein and paracasein bodies are plastic, and neither is the paracasein in cheese always plastic. This depends on the method of manufacture, degree of ripening, and acid development in the cheese.

When the cheese is heated there is at first a slight separation of butterfat, so that the cheese particles appear oily. With more heat the cheese becomes plastic or stringy, forming a continuous phase which gradually entangles the other cheese ingredients, making a homogeneous mass. At this stage the cheese is said to "pull up." This is called the "plastic" state. Upon further agitation the plastic condition is gradually "broken down" and a homogeneous mass resembling very heavy cream results, which has only slight plastic properties.

The length of time that the cheese will remain in the plastic state on heating depends on several factors, such as degree of ripening, variety of cheese, acid content of the cheese, etc. Swiss cheese will usually retain this plasticity longer than American cheese. The cheese may remain in this plastic state anywhere from a few minutes to several hours. Once this plastic condition has broken down it is very difficult, if not impossible, to bring it back again.

The creamy homogeneous cheese, which is the last stage under the heating process here described, has the casein and the fat very intimately mixed, and here we probably have a condition where the oil particles are covered with a very fine layer of colloidal casein, which makes it very difficult to remove the fat from this cheese by ordinary methods. For instance, when this cheese is heated in an oven at 100° C. the fat, although it has a melting point of 37° C., does not flow free from the casein. Such a cheese is not very suitable for toasting purposes in the home. On the other hand, the fact that the casein surrounds the fat so intimately, and also since some of this fat exists in the emulsified form, this cheese should be more easily digested in the stomach than our ordinary cheese. This is a point which would bear further investigation.

BLENDING OF CHEESE.

For best results, cheese having the desired properties must be blended. This is the surest method of getting reliable results. Pasteurization always brings out the defects in the cheese.

To get the best results an examination of the paracasein must be made. Also the character of the finished product desired must be considered.

An analysis is given of a typical cheese that is suitable for Pasteurization:

	Per cent.
Moisture	36. 87
Ash	3. 03
Salt	. 35
Lime (CaO)	. 98
Total N	4. 27
Water-soluble N	. 65
Salt-soluble N	3. 35

Acid, 120 c. c. N/10 NaOH per 100 grams of cheese.
Formol titration, 58 c. c. N/10 NaOH per 100 grams of cheese.

APPLICATION OF PROCESS TO DIFFERENT KINDS OF CHEESE.

The Pasteurization of cheese has a wide application. American Cheddar, Swiss, brick, Limburger, and even Camembert cheese have all been successfully treated. There are several exceptions in the soft cheese group, due to certain complex changes in the casein.

THE EFFECT OF TEMPERATURE AND SALTS.

The temperature is very important and must be watched carefully. Some cheeses can stand more heat than others; for instance, the cheese that has not cured very long and has a tough body will stand a temperature of 150° F. easily, while other cheese slightly weak in body has to be handled more carefully.

Now the question is often asked whether cheese can be heated to such high temperatures without materially affecting the texture and flavor. As for the texture, this has already been discussed, and it has been pointed out that if certain factors are properly watched, a product can be obtained with a very good texture resembling in many ways the original cheese from which it is made. The flavor of the cheese is not materially affected. For instance, it is not very difficult to detect when a Pasteurized product has been made from a well-cured cheese.

Certain salts are important from the standpoints of both effective Pasteurization and proper emulsification. Sodium chloride is of course very effective from the standpoint of killing the bacteria during the heating process, but if too much of it is used it stiffens the product and causes coarseness.

Chairman Sammis. The paper is now open for discussion. Are there any questions?

Dr. D. C. Carpenter (New York State Experiment Station, Geneva, N. Y.). I should like to inquire of Mr. Robinson as to which of the calcium caseinates he holds responsible for the plastic properties of cheese, if any one of them is singled out.

Mr. Robinson. We have carried on the work as indicated here, but in greater detail. As far as I can tell, the importance of calcium caseinates there is not very great, and I would not attribute the plasticity to the calcium base.

Doctor Carpenter. You would attribute it to a perfect casein?

Mr. Robinson. Yes; I would. I would say that plasticity is due to certain changes that the casein has to go through and which would probably cause a certain reaction between the casein and certain acids that form during the matting in the curds.

Chairman Sammis. Is there any more discussion?

I am happy to announce that our honorary chairman, Doctor Burri, has arrived, and I will ask him to come forward.

(Doctor Burri came forward and occupied a seat on the platform.)

Chairman Sammis. The next paper is "Pasteurization of milk for Cheddar cheese making in New Zealand," by Mr. Charles Stevenson, dairy instructor, Department of Agriculture, New Zealand.

Is Mr. Chas. Stevenson in the room? If not, I think I will call upon Mr. J. A. Ruddick, Dominion Dairy and Cold Storage Commissioner, Ottawa, Canada. He is familiar with Pasteurization in New Zealand, as he has made a visit there.

Mr. J. A. Ruddick. Mr. Chairman, ladies, and gentlemen: I am very glad to say a word or two from the standpoint of a practical cheese maker on this question of Pasteurization of milk in New Zealand. I lived in New Zealand and was chief of the dairy division there some 20 years ago, and revisited the country last winter. I know the character of New Zealand cheese, and having been a cheese maker in my younger days I have kept in close touch with the development of the industry in New Zealand. During the intervening years I have seen a great deal of New Zealand cheese on the markets in the old country.

Some five or six years ago they began this process of Pasteurization of milk for cheese making, and you can understand that it was with very considerable interest that I examined the cheeses when I was there last winter. I tested many hundreds of cheeses in the grading stores and the factories. They are now Pasteurizing about 80 per cent of all milk converted into cheese, and it is their aim to make it universal. It is only a matter of getting equipment. I will describe the equipment first.

They use what is known as a universal Pasteurizer. It is obtained in Denmark, and is of the regenerative type, and, therefore, it is economical to operate. The milk is heated to a temperature of from 160° to 165° F. It is then passed over a cooler, usually a brine cooler, but in some cases a direct expansion cooler. The temperature is reduced to 90° F. as the milk runs into the cheese vats. A starter of about 1½ to 2 per cent is added. The cheese makers here will understand that once the milk has been Pasteurized and a starter of uniform character added, the rest is largely routine. You can make a time table for it and set a novice at the work and he can turn out good cheese, and that is, to my mind, one great advantage. The cheeses which I saw in New Zealand were very uniform day after day and week after week. If you compare one factory with another you can not find the difference. So much for uniformity.

Now this is what has been accomplished. In the old days there was a good deal of trouble with a rather dirty flavor in the New Zealand cheese. There are certain times of the year in New Zealand when the milk that is used is not ideal. In the rainy season, the yards and places where the cows are milked get rather deep with mud, with the result that the milk is not always in the best condition. Many producers in New Zealand began without experience as dairymen. They were men from other walks of life, who had taken up a bit of land and begun to practice dairy farming. Now that the milk is Pasteurized the flavor of the cheese is cleaner and the texture silky, and the cheese has the meatiness that is so much in demand on the British markets, instead of that rather stiff, firm cheese that used to be the general standard for Cheddar cheese.

The cheese is of softer texture largely because of more moisture being retained in it. They find they get an average yield of 2 to 3 per cent more cheese from the milk when it is Pasteurized, and it is largely because it retains more moisture. That is an advantage in the markets of the present date; that is the type of cheese that is in demand, a cheese which is meaty and soft, but still firm enough to stand up well. I naturally have been giving a good deal of thought to this matter of Pasteurization of the milk, and I am not convinced that it is a practical question in our country and yours. Even the smaller factories in New Zealand make three or four hundred tons of cheese a year, and that would be a fairly large factory in this country. Nearly all of them have refrigerating plants by which the milk is quickly cooled down to around 90° F. In many factories that would be impossible if they did not have such equipment. I think that is all I have to say. I thank you.

Chairman SAMMIS. Is there any question on this subject?

Dr. A. J. SWAVING (chief inspector of dairying. Holland). Did I understand you to say that all the milk that was used for Cheddar was Pasteurized?

Mr. RUDDICK. No; I said about 80 per cent of the factories Pasteurize their milk. They have not all adopted it.

Doctor SWAVING. In Holland the whole milk is Pasteurized and then we take 80 per cent milk and add some raw milk. In addition to that we sometimes take wholly Pasteurized milk.

Another question is this: Did you make a chemical analysis of the cheese? It would be most interesting to me to know if the proportions between proteins and fats will change in cheese which is made from Pasteurized milk. I should be glad if somebody could give some information about that, because we have very little data on that matter.

Mr. F. W. BOUSKA (superintendent, manufacturing, Beatrice Creamery Co., Chicago, Ill.) It appears that the harder cheese can not be manufactured in the warmer climates because of the higher temperature that prevails there.

Mr. RUDDICK. You mean Cheddar, don't you?

Mr. BOUSKA. Yes.

Mr. RUDDICK. Of course, you know that New Zealand has not so hot a climate as New York. In New Zealand the climate rarely goes over 85° F. I will tell you this: In Australia where they have a semi-tropical climate the cheese manufacture is developing more than in any portion of Australia. It is not Pasteurized there, though.

Chairman SAMMIS. Is there any further discussion? If not we will proceed to the next paper: "The relation of ensilage to cheese making," by Doctor Burri. [Applause.]

Doctor BURRI. Ladies and gentlemen: I take this opportunity to voice my appreciation of the honor that has been given to me by my appointment as your honorary chairman. I think the honor has not been bestowed upon me as a man, but upon my country which was the first to go into the investigation of the organisms in cheese.

I trust that my language will not be a serious hindrance for the exchange of our ideas and experiences.

THE RELATION OF ENSILAGE TO CHEESE MAKING.

ROBERT BURRI, Ph. D., director of the Swiss Dairy and Bacteriological Research Station, Liebefeld, Bern, Switzerland.

The preservation of green fodder as ensilage and the manufacturing of cheese have many features that may be studied in parallel. Both concern agricultural products, which at certain seasons are produced in excessive quantities and which may be kept in a durable form that will permit them to be used later. Whether the whole or only a part of the foodstuffs can be kept in a preservable form, is a question of secondary importance. The preparation of both products is dependent upon fermentative processes, that result from the activity of certain microorganisms. The silage, as well as the green cheese, affords certain important conditions conducive to the development of the microorganisms. These conditions are rich nourishment, moisture, and warmth. The microbiological conditions form a very important relationship between products that to casual observation are as diffierent as cheese and silage, and a study of the influence which the microflora of the ensilage can have on the microflora of the cheese, from a scientific standpoint, would have been justified and no doubt begun even without the urgent inducement arising from the bad results obtained in practice.

I. CONDITIONS NECESSARY FOR THE GROWTH OF MICROORGANISMS IN SILOS.

If one considers that in order to have fermentation there is required not only special nourishment with certain favorable physical conditions, but also the presence of the typical fermenting bacteria, it seems that the conditions in the silo must be right, for, in general, vegetable matter, either green or half dried, is a carrier for countless microorganisms of all kinds. These are deposited on the plants by air currents or have grown on the plant. Hundreds of thousands of fermenting bacteria can be found in 1 gram of grass used for ensilage. Now to secure certain fermentations it is not so important that there be a great many organisms, but that the proper kinds be not lacking. Then too, in this respect, the situation in the silo is generally favorable for the growth of the lactic acid bacteria, which may be observed as the strongest natural factor in preserving organic substances and which are especially numerous in all fresh vegetable matter. These advantageous conditions are not common to all vegetable offal, because previous handling may free it from microorganisms; for example, the beet waste from sugar factories. Such material can be made useful by the inoculation of certain lactic acid bacteria.

In order to understand well the action of microorganisms in the silo, we must take into account the fact that the totality of the conditions controlling the packed mass influence the microorganisms in such a way that, as a rule, only a few varieties persist and through their action the final product, the silage, is given its peculiar character. In other words, the growth of the bacteria depends upon the nature of the vegetable matter used, its ripeness, its moistness, the fineness of its particles, the more or less thick layers, and other circumstances which this or that kind of organism finds advantageous to its growth. Certain conditions of growth control the occurrence and activity of a typical microflora and this flora regulates the special characteristics such as nutritive value, color, taste, and smell of the ensilage. Of course these characteristics are explained on the other hand by chemical and microbiological analyses of ensilage.

II. THE RESULTS OF BACTERIOLOGICAL TESTS OF SAMPLES OF SWISS FODDERS.

Although the kind, condition, and placement of the silage is known to be decisive for the growth of the bacteria and thus for the final character of the silage, this relationship is not so comprehensive that one could definitely predict the microbiological nature of the product from the summation of all agencies active in it. It is almost impossible for one to describe the bearing of particular measures and conditions according to their mutual interaction taking place and effecting changes in the silage. A mixture of plants, for example, meadow grass, requires different and less-defined conditions for growth than does a singly constituted silage such as corn. But even with corn, a variation in the degree of ripeness that has been found best in practice, or unfavorable weather conditions during the growing period, could have a consequent effect due to the difference in the amount of water given off in the silo, or perhaps because the respiration has been diminished. Such conditions affect, fundamentally, the life of the bacteria, the moisture, oxygen content, and temperature, and it is easily seen that an alteration of these conditions is also an alteration of the correct bacterial development and therefore determines the resultant quality of the ensilage. From this it may be concluded that the biological nature of the final product of a certain silo may be predicted, judging from the nature of its contents, but reliable information can be obtained only by examining the ensilage in each case.

Concerning the processes that we have used during the last five years at our experiment station, we will discuss separately the three types: Sweet fodder, electrically treated fodder, and sour fodder. This order, which is not correct in regard to historical development of conserving fodder, was chosen because in the light of later developments the above-mentioned types succeed one another more logically in respect to scientific and practical experimentation. We will not discuss the chemistry of the food values, technology, or economic aspects of the silage question, but only the bacteriology of the following types:

Type A. Sweet fodder (*sweet green fodder*).—Some years ago some Swiss farmers recommended this scheme of preserving fodder, which consists in piling up layers upon layers of somewhat dried vegetable matter (originally and especially grass). This process causes a sudden and rather high temperature that kills most of the organisms which are sensitive to heat and thus, in a way, effects an automatic sterilization of the fodder, at least in the opinion of its advocates. The fundamentals of this conservation process had already been explained by an American named Miles, in 1883. After numerous samples had been taken from such silos the bacterial condition was characterized by three things: Presence of a very large number of the so-called hay and potato bacilli, total absence of lactic acid bacteria, and the presence of butyric acid bacilli ranging in quantity from copious to excessively large numbers. These bacilli were, as a rule, in the spore form, as were also the hay and potato bacilli.

The method of making this silage explains its microbiological nature. After loosely packing the silage, the temperature rises quickly to about 50° C. and more, and consequently the ordinary lactic acid bacteria are destroyed, and those that have survived the higher temperatures, for other reasons, find it difficult to sustain themselves. Absence of lactic acid fermentation is, however, generally in mixtures of organic substances, one of the conditions of growth for different spore-forming organisms, especially the acid-sensitive hay and potato bacilli.

It should not be said that the butyric acid bacilli necessarily, or as a rule, develop in sweet ensilage. Their absence in certain parts of the silage, as well as the decrease in bacilli count in different silos, leads us to believe that the measure of their development in silage is dependent upon very distinct conditions that have not yet been discovered. The occurrence of butyric acid bacilli in so-called sweet green fodder gave basis for our warning Swiss farmers against its use. These organisms, as we shall later see, have proven themselves to be the worst evil in the manufacturing of Emmental cheese.

Type B. Electrically treated silage.—The recently developed idea of running an electric current through green silage to preserve it deserves some attention. Indeed, one should not expect on the grounds of earlier knowledge of the effect of electric currents on microorganisms, that the bacteria would be destroyed and the silage thus preserved, as was the idea of the inventors. But we must admit the possibility that heat generated by the alternating current in the ensilage, which is the resistance, can have a beneficial effect on those conditions which take place during the conversion of the fodder into ensilage. This effect induces, above all, the activity of the organisms which is retarded in cold, wet fodder for the reason that the warmth produced by the respiration of the plant cells is taken up by the relatively large amounts of water and so the stimulating effect on the organisms, and particularly the lactic acid bacteria, is lost. The inventors therefore advertise, as an important advantage of this method of conserving silage, that any vegetable matter of suitable nature and moisture content can be utilized in this way.

We were interested most in the questions bearing on the bacteriological nature of this type of conservation. From the very first tests of samples put at our disposal by the inventors the presence of millions of lactic acid bacteria has always been indicated, and it was hoped that the occurrence of a lactic acid fermentation would suppress the growth of butyric acid bacilli. The distillery affords an old familiar process whereby a strong lactic acid fermentation may be induced in the mash so that the butyric acid fermentation is suppressed. But we were disappointed in our expectations. In the electric silo erected at our experiment station, as well as in similar silos belonging to farmers, an ensilage was produced which, to be sure, contained a strong growth of lactic acid bacteria, but also a quantity of spores of the harmful butyric acid bacilli, which made the electrically treated silage appear little better than the sweet ensilage for use in producing milk for Emmental cheese.

There is no doubt that a lactic acid bacteria fermentation can not under all conditions suppress the growth of butyric acid bacilli, and this opinion is substantiated by various laboratory tests which can not be discussed in this paper. We also know that other experimenters have made more successful tests with electrically treated silage, and we might well believe that occasionally this process does produce a silage that from a microbiological standpoint could not be contested as to its use for the production of milk for cheese. We have also found exceptional cases of sweet silage, that showed a low count of butyric acid bacilli. But an ensilage, whose process of production can not be controlled so that perfect quality is the rule, proven by the exceptional failure, can not be considered for the production of milk used in the manufacture of a high-class export cheese like the Emmental.

Type C. Sour silage.—The preservation of plant waste of various kinds (chiefly beet leaves) by packing and pressing in pits, or also in stone jars, is no doubt the oldest method of utilizing the preserving powers of the plants themselves or of the bacteria which they bear. In this process, to which type the preparation of sauerkraut belongs, various organic acids occur as a rule as the by-products of fermentation, among them certain volatile acids, which give the silage a peculiar taste and smell. It was wrong to call a preservative "sweet" because it lacked an acid smell; nor in the narrow sense of the word is it sweet, but in reality acids are formed and among others lactic acid, which is stable and odorless. The purpose of producing a green-silage preservative that would not smell of volatile acids coincides with the purpose of inducing a pure lactic acid fermentation in the vegetable matter. Therefore the fermentation must be produced by those kinds of lactic acid bacteria which form only lactic acid and no volatile acids, and all fermentative organisms, whose characteristic metabolic products are volatile acids such as acetic and butyric acids, must be excluded. It has been shown in our experiments that this exclusion is not easily accomplished, and that a strong growth of the ordinary *Streptococcus lactis*, for example, does not prevent the growth of butyric acid bacilli. Entirely different conditions must be obtained if harmful bacilli would be eliminated from the vegetable material which will later be converted into milk used in cheese making. We believed that this condition might be brought about by the use of green-corn silage, in view of the success of American farmers with this type. The silage tests carried out at Liebefeld, using in one case green corn and in another corn that had been allowed to dry in the field, have yielded a silage which, like the above-mentioned types, is quite unsuitable for the production of milk used in the manufacture of Emmental cheese, because of its butyric acid bacilli content. We achieved a better result in our tests with green corn ensilage, prepared after the American fashion, in which special importance is attached to the experience of the American farmer who found that corn cut when the kernels were beginning to ripen gave the best silage. Of all ensilages tested, this was the only one that showed a butyric acid bacilli count not higher than the ordinary green fodder of Swiss farms. It is most probable that Emmental cheese prepared from milk produced from this silage will not show signs of inflation or those other defects that are known to be traceable to the ensilage. Whether or not the taste is affected by the influence of such ensilage can only be determined by experimenting on large quantities with the necessary controls.

From a bacteriological standpoint, the question might be raised as to why in filling the silo with corn of the desirable ripeness, a low butyric acid bacilli count was obtained in this silage, while green corn, cold or artificially warmed by an electric current, in spite of the preponderance of lactic acid bacteria, gives an undesirable number of the noxious bacilli. The discussion of this question will not be undertaken here, except to mention that our corn ensilage (prepared in the American fashion) gave very decided rod-shaped bacteria (so-called lactobacilli) in a natural, pure culture and many millions of these bacteria per gram. The corn plant at a certain stage of maturity seems to lend itself very well to the lactic acid fermentation and to the exclusion of other fermentations, and it is remarkable that in this case, as also in other previous cases, extensive use has shown and proven that which has been subsequently determined scientifically to be the most desirable.

III. EXPERIMENTS ON THE SUITABILITY OF MILK FROM SILO DAIRIES FOR CHEESE MAKING.

Influenced by the widespread propaganda that was current in the early eighties, numerous investigations concerning the preservation of green fodder were carried on in Switzerland. Wherever Emmental cheese was made of the milk from cows fed chiefly on this ensilage, defective cheese was produced. These experiences ought to have been taken into consideration, but they had been made a long time ago and therefore had lost their discouraging effect; on the other hand the advocates of the old idea put into new terms claimed to possess now a better method, which was the sweet green-fodder method mentioned above.

From the very first use of silage in our experimental dairy, serious defects appeared in the cheese, namely, an excessive number of large holes, that is, inflation to the extent of splitting the rind, and also bad flavor and smell. The same defects appeared in the cheeses of other creameries in the country that had been using milk from silage-fed cows. The bacteriological investigations of the defective cheese revealed a large number of the mobile butyric acid bacilli, and since the same organisms as a rule are found in large quantities in sweet green-fodder ensilage, there could be no doubt as to the relation to the bacteriological nature of the cheese. The beginning and ending of the inflation of the cheese coincided so decidedly with the beginning and ending of the feeding of the silage, and the effect of the butyric acid bacteria was so pronounced, that in the future the judgment of a new type of feed and particularly ensilage will depend upon its butyric acid bacilli spore count.

That we have thus discovered the right method was proven in our tests with electrified silage and with the different types of sour silage. Wherever milk was used that had been obtained from cows fed on this kind of feed the results were no better than where sweet silage was used, and the entire experimental evidence obtained during the last few years justified the attitude of the Swiss dairymen in turning against all kinds of fermented feeds. More will be said later regarding the exceptional case of American corn silage.

Especially noteworthy, and strongly indicative of the danger arising from the use of feed containing butyric acid bacilli, is the condition that the cheese maker has no means of detecting the noxious bacilli in fresh milk. While the technician, by the fermentation test, can easily recognize the presence of undesirable gas-forming organisms of the group *B. coli*, the spores of the butyric acid bacilli do not reveal themselves so readily. They do not germinate in milk at 30° to 40° C., and milk samples containing thousands of these harmful organisms can be apparently satisfactory when judged by ordinary examination. Thus, during the manufacture of cheese made from this questionable "silage milk" the danger can not be observed at first, and not until after several weeks, when the cheese is in the fermenting room, do these unfavorable tendencies begin to appear. The nonproduction of butyric acid bacilli spores in milk is one of the peculiarities especially characteristic of this bacillus, as is also the fact that the presence of these undesirable bacilli is in no wise disturbingly noticeable in the preparation of cheese made from skimmed milk. That just the highly heated Emmental cheese affords an excellent growth for the motile butyric acid bacilli is obviously correlated to the acid condition, which is in this type of cheese most favorable for the bacilli, and to other conditions which are still undetermined.

IV. THE TRANSMISSION OF MICROORGANISMS FROM THE FODDER INTO THE MILK.

The germination in milk of organisms originating in the feed can be accounted for in many ways. In the first place, if we consider that the people who care for the feeding usually look after the milking too, and that with bacteria on their hands after handling the feed they milk the cows and attend to the milk utensils, it is evident that it is only a short step to the actual infection of the milk. It is also possible that particles of the food are conveyed to the milk through the manipulations of the attendants. A dispersion of harmful microorganisms by air currents is barely possible in the case of moist silage.

Our investigations have led us to conclude that the most feasible mode of transferring the infection is through the alimentary canal of the cow—that is, the harmful butyric acid bacilli from the ensilage are conveyed into the milk from the feces of the cow. As one might conclude, the butyric bacilli are in the form of spores at the time the fodder is used. These are not destroyed by the juices of the digestive system and are excreted with the undigested particles of the fodder in a form capable of regerminating. A germination of spores and an increase in the numbers of bacilli do not seem to occur in the body of the animal. Relative to this it may be said that the butyric acid bacilli count in the feces rises and falls in accordance to the increase or decrease in the butyric acid bacilli content of the feed.

Now one could not say that the transmission of bacteria from the manure into the milk would be possible only with gross neglect in the sanitary handling of the milk during milking. This transportation is accomplished largely by indirect processes. The usual contamination of milk is explained by the fact that manure frequently gets on the flanks and udders of the cows, dries there, and can not be removed by the helpers. Then, too, some dried manure can be blown as dust around the stable and each small particle may carry any number of bacteria. It is not necessary to explain the possibility of infecting the milk during milking by the unavoidable shaking off of dirt particles from the cow's body, if we consider that the count for butyric acid bacilli spores is millions per gram, and therefore thousands per milligram, and that the fractional part of a milligram can effectively inoculate the quantity of milk used in an ordinary Emmental cheese.

V. ON THE QUESTION OF THE RELATION OF THE SO-CALLED "STINKERS" TO EMMENTAL CHEESE SPOILED BY BUTYRIC ACID FERMENTATION.

As was previously mentioned, the butyric acid bacilli usually enter the milk and cheese in the form of spores. The very presence of the spores in the cheese mass would not be detectable were it not for the development of the spores into bacilli in the cheese, with their consequent increase and the formation of the characteristic by-products, gas and butyric acid. Other organisms also enter into the milk and would be equally harmful, were they able to sustain themselves. The hay and potato bacilli, for example, could dissolve the cheese and change it to a slimy mass. Fortunately, these organisms do not find favorable conditions in the cheese, and for this reason it makes no difference if there are larger or lesser numbers of spores of the kinds in question in the cheese milk.

Similar experiences are had, at least in Switzerland, with *B. putrificus.* This organism possesses a very dangerous characteristic, inasmuch as it can, with complete exclusion of air, dissolve the casein and thus separate out the strong-smelling and strong-tasting by-products of metabolism. The spores of these bacilli are widely spread in nature; and inasmuch as they are contained in the feces of domestic animals, it is not surprising to find them in milk and cheese. In our own experiments with Emmental cheese they were found regularly, but in small numbers. It is important and fortunate that they are not able to grow and reproduce except under especially favorable conditions. Now and then, but only seldom, certain cheeses from a creamery show defects, namely, parts of the inside appear white and crumbly, with large irregular holes, and have a bad taste and smell which permeate the good parts. The bacteriological examination of such cheese, as a rule, shows the presence of spore-forming *B. putrificus* and such cases were at once called putrificus cheese. Under what conditions the usually harmless putrificus bacilli ferment in the cheese and cause bad results is yet to be determined.

With the discussion of the characteristics of putrificus cheese we are reminded of the "stinkers," which are a source of considerable loss for American cheese makers. The putrificus cheese also is really a stinker, and the analogy of both types of defective cheese is easily understood when one remembers that the specific flavor and smell of stinkers are largely due to *B. putrificus.* We have discovered thousands of spores from that bacillus in a single gram of stinker cheese which we have had occasion to examine and, in addition, hundreds of thousands of butyric acid bacilli spores. In this respect, that is to say, the high content in butyric acid bacilli, the American stinker differs from our Swiss putrificus cheese. So, from a bacteriological standpoint, the defective type stinker might be a combination of defective types of putrificus and butyric acid bacilli cheese.

With reference to this circumstance one can not put aside the reflection in regard to the origin of the stinkers, that with the latter as well as with butyric acid bacilli cheese, an infection of the milk and consequently of the cheese, with large quantities of butyric acid bacilli, plays the chief rôle, and this evil can be controlled only by avoiding the source of infection. In Switzerland it is well known that the source of infection lies in the use of unsuitable silage, and the same might be the case in America. This suspicion has also been expressed among American Swiss cheese makers who believe the widespread use of silos to be responsible for the numerous defective products, especially stinkers. However, modern scientific practice may well recommend the use of corn for silage, as it would not have been possible by any other manner to bring the agricultural and dairying industries in the United States up to their present high stage of development. Therefore the use of silage must not be reduced, but the technical side of silage preparation ought to be developed to the highest efficiency so that it will be possible to determine a practical control for the dangers of infection, which result from the use of milk affected by harmful biological agencies acting through the silage. With all due care in the handling and preparation of the silage there are still factors which play their part in determining the quality of the silage, and which can not be controlled except by more or less appropriate adaptation to their presence. On these grounds the opinion is justified, that the American corn silo affords that method of preservation which allows a pure lactic acid fermentation to come up in the fodder, with exclusion of the fermentation of harmful allied organisms; although for other reasons the quality of this ensilage is sometimes inferior, at least with respect to the production of milk for Emmental cheese. *The numerous defective products found in American cheese factories as the result of butyric acid bacilli and other spore-forming organisms might be explained for the present by the use of unsuitable ensilage in certain dairy farms.*

Chairman Sammis. I am sure Doctor Burri will be pleased to answer any questions you might have.

Dr. G. L. A. Ruehle (Michigan Agricultural College). I should like to ask how the sweet silage you spoke of is made?

Doctor Burri. It is made in the following manner: Layers of grasses are cut and half dried and piled on layers so you have a very, very quick rise in temperature. Temperatures are raised to 45° to 50° C. in a very short time. When the weather is beautiful you can put in a layer of about 6 feet, so you have at least a mass or package at a temperature of 45° or 50°. This temperature is strong enough to destroy lactic acid forming bacteria and give better condition for the spore.

Doctor RUEHLE. Is that soon after it is made or is it kept for a considerable time? I mean how long after it is prepared is it suitable for feeding to the animal?

Doctor BURRI. Usually they begin feeding it in December. Sometimes the grasses are cut in May and June, or about the time they are making hay.

Chairman SAMMIS. Doctor Burri, isn't this silage pressed under a screw so as to press it together tightly and exclude the air?

Doctor BURRI. Yes; it is made under pressure, but only after it has been finished. The pressure is a means to keep the temperature at a certain height.

Chairman SAMMIS. The tighter you press it, the cooler it stays, is that it?

Doctor BURRI. Yes. This kind of silage was used about 1830, I believe. The process is called from a Frenchman, but I believe it came from America.

Doctor RUEHLE. How do you explain the entrance of the bacteria into the milk.

Doctor BURRI. By manure.

Chairman SAMMIS. Doctor Burri, with reference to the third slide from the end in which you showed a large bloated cheese broken apart. I remember seeing such cheese at the factory. They produced such cheese right along for a time and we thought it was due to yeast at that time, because the first day when we steamed the whey the trouble stopped, so it did not seem to be due to anything which had spores in it. I presume in many cases the germ produced this.

Doctor BURRI. After our experiments we came to the conclusion that yeast can not spoil a cheese in this manner. Very seldom do we have this effect with the yeast.

Chairman SAMMIS. Are there any further questions? Gentlemen, the next subject on our program, and we shall have to move along rapidly, is "The use of bacterial cultures for controlling the fermentation in Emmental cheese" by Dr. J. M. Sherman, bacteriologist, United States Department of Agriculture.

THE USE OF BACTERIAL CULTURES FOR CONTROLLING THE FERMENTATION IN EMMENTAL CHEESE.

JAMES MORGAN SHERMAN, Ph. D., research laboratories, Dairy Division, United States Department of Agriculture.

It is the purpose of this paper to deal with the progress which has been made by the United States Department of Agriculture in the improvement of our domestic cheese of the Emmental type by the use of bacterial cultures. The developments which have taken place in this work in America are not so much the discovery of the types of bacteria in Emmental cheese (that was done by von Freudenreich and his various coworkers many years ago) as their application in the industry.

THE CONTROL OF THE INITIAL FERMENTATION.

In order that the proper fermentation of the lactose may be initiated, and undesirable fermentations, especially gassy fermentations, suppressed, Doane and Eldridge used a culture of *Lactobacillus bul-*

garicus. 8his organism, which is closely related to the *B. casei* ε of von Freudenreich (*Thermobacterium helveticum*, Orla-Jensen), has now been used in this country for a number of years with marked success.

Contrary to the experience of some of the European workers with the helveticum type, the *Lactobacillus bulgaricus* which we have used does not appear to contribute directly to the flavor of the cheese, though indirectly, through the suppression of undesirable bacteria, a general improvement in quality is effected.

In factory practice this culture can be propagated in bulk without difficulty in either whey or skimmed milk. On the whole, we have found milk more desirable for this purpose, as a convenient practical check can be maintained on the purity and condition of the starter by an examination of the nature of the curd formed. An incubation period of 18 hours at a temperature of about 45° C. has given very satisfactory results under factory conditions. Although *Lactobacillus bulgaricus* makes a rapid growth at lower temperatures than 45° C., it has been found that the troubles from contamination, under the practical conditions obtaining in the factory, are reduced when the higher temperature of incubation is used. While the amount of the bulgaricus starter which may be used in the manufacture of Swiss cheese can be varied considerably without apparent effect upon the finished product, the rule which has been followed in this country is to use a quantity equal to 0.5 per cent of the volume of milk employed.

THE PRODUCTION OF EYES AND FLAVOR.

Although it was over 15 years ago that von Freudenreich and Orla-Jensen isolated propionic acid-producing bacteria from Emmental cheese, practically nothing was done during the decade following their discovery toward the practical utilization of these organisms in the manufacture of cheese. In America, the domestic cheese of the Emmental type is usually lacking in the characteristic sweetish flavor, and is frequently either deficient or abnormal in eye formation.

To overcome these defects we have used a variety of the propionic acid-producing bacteria, *Bacterium acidi-propionici* δ which insures the development of the characteristic flavor as well as the formation of eyes. Five years' experience with this culture in both laboratory and factory experiments has convinced us that it is the most essential of any single organism to the production of the desirable characteristics of Emmental cheese. Although it appears to be able, almost by itself, to produce the desirable qualities of Emmental cheese, it apparently plays little, if any, part in the suppression of the undesirable organisms which so frequently injure the quality of the cheese.

While large cheese companies which maintain laboratories can grow the propionic organism for their own use, this procedure does not seem practicable for the small factories. We have, therefore, grown this culture in central laboratories so that it can be supplied in convenient sized bottles to the smaller factories. Grown in a medium consisting of 2 per cent pepton and 0.3 per cent lactose, this culture may be held for at least two weeks at ordinary factory temperatures without any apparent loss of its efficacy for cheese-making purposes. In this medium, using about 1 cubic centimeter of inoculum to 1 liter of broth, an incubation period of from three to seven days at laboratory temperature is required to obtain a heavy growth of the organism. In practice, from 100 to 200 cubic centimeters of this culture to 1,000 pounds of milk has been found sufficient for the proper inoculation of the cheese.

During the past few years the value of the propionic and the bulgaricus starters in factory practice has been amply demonstrated. Cheeses made with these two cultures have won many prizes at scoring exhibitions and fairs. Only a few weeks ago, cheeses made with these cultures won the first six places among the Swiss cheese exhibited at the Ohio State Fair.

THE CONTROL OF OVERSWELLING.

A frequent difficulty in the manufacture of Emmental cheese in America, and perhaps elsewhere, is a tendency for the cheese to overswell. The cheese so affected usually develops more rapidly than the normal cheese, but sometimes this overswelling occurs in cheeses which have not developed abnormally fast. While defects of this nature are probably due to various causes, very encouraging results have been obtained in their control under certain conditions by the use of another pure culture.

The organism used for this purpose is the organism originally found in cheese by von Freudenreich and named by him *B. casei* α. As is well known by everyone who has studied the bacteriology of Emmental cheese, this organism develops in large numbers during the curing process, and is the type which is usually found predominating in the well-ripened cheese. It might seem, therefore, that there is nothing to be gained by the inoculation of the milk for cheese making with this organism, but in certain types of overswelling we have found that its use had a marked beneficial effect in the control of this trouble.

On the other hand, we have experienced cases of overswelling in which the use of this culture did not in any degree remedy this undesirable condition. During the past winter this organism was used with most striking results in a factory in California. At the time of its introduction nearly all of the cheeses being made in this particular factory had a tendency to continued swelling after the eye formation had reached the proper stage, and this continued development could not be checked by the removal of cheeses to the cold room. Under these conditions our first attempts at the control of overswelling by the use of *Lactobacillus casei* were met with marked success; while cheeses in which this culture was not introduced overswelled badly, other cheeses made from the same milk in which this culture was used ceased development entirely when the eye formation had reached the proper stage. Notwithstanding the extremely successful results obtained through the use of the casei starter in this factory during the winter months, during the past summer the results could not be duplicated at all. Although used in the same factory and in the same way in all respects, this organism failed entirely to suppress the tendency of the summer cheeses to overswell.

To sum up our experience with the use of *Lactobacillus casei* it can only be said that there appear to be conditions under which it may prove to have a distinct value to the manufacturer of Emmental cheese, while under other conditions its use would appear of little if any value. At any rate, this is a problem which merits further study under diversified conditions and in widely separated regions.

Chairman SAMMIS. Are there any questions?

Doctor ORLA-JENSEN (Denmark). I am very glad to hear that paper of Doctor Sherman, but there are some things mentioned in there that I do not agree with, and which are not used in Europe. It is very interesting for me to hear this paper. I agree that the eyes are produced by the propionic acid bacteria, but I hold that the sweet flavor of the Swiss cheese is caused by one of the lactic acid bacteria.

Doctor SHERMAN. I believe if Doctor Orla-Jensen would try our cultures he would find that they played a very large part in the production of flavor, a very much larger rôle than he now believes.

Chairman SAMMIS. As there are no further questions, we will proceed to Mr. Matheson's paper: "New developments in the manufacture of Swiss cheese." [Applause.]

NEW DEVELOPMENTS IN THE MANUFACTURE OF SWISS CHEESE.

KENNETH JESSE MATHESON, research laboratories, Dairy Division, United States Department of Agriculture.

Domestic Swiss cheese was first made at New Glarus, Wis., in 1854. The annual production at present, including both block and wheel, amounts in round numbers to 20,000,000 pounds, which is nearly all produced by the small cooperative factories in the States of Wisconsin and Ohio. The smaller factories produce from 2 to 4 cheeses daily during the season from April to the end of October. Practically all the small factories receive their milk twice a day, in contrast with the larger factories, which receive their milk but once a day. The smaller factories are provided with curing rooms to hold their output from three to four months, whereas a few of the larger factories are provided with refrigeration and curing space to hold their cheese for a much longer period, with resulting improvement in the quality. Some of the larger factories make cheese during the entire year. There have been several developments in the manufacture of Swiss cheese which may be listed as follows: The standardization of milk, the use of cultures, the centrifuging of milk, and the use of oxygen for suppression of gas.

THE STANDARDIZATION OF MILK.

From June to September there is always more trouble in the smaller factories with glaesler cheese than in any other period of the year. Formerly both culture and nonculture factories resorted to little or no standardization during the summer months, and there were many complaints of glaesler cheese. During the summer months under our climatic conditions, unless artificial refrigeration is available for the curing rooms, there appears to be danger of glaesler cheese, even though the percentage of fat does not average over 3½ per cent. In the culture factories there is less loss of fat in whey than in the homemade rennet factories. In the former case the loss usually runs from 0.6 to 0.7 per cent, whereas in the latter case the loss runs to 1 per cent, or higher. It is, therefore, obvious that standardization should be resorted to for the purpose of correcting this difference in whey loss. As has been shown by various investigators, both fat and casein decrease during the summer months, but the casein decreases more in proportion than does the fat. To bring about the proper balance between these constituents it seems advisable to standardize the milk from which the Swiss cheese is made.

In order to guard against glaesler cheese and to arrive at the most desirable relationship between the fat and casein during the summer months, determinations were made upon the milk of a number of factories for these solids. This examination of milk included both culture and nonculture factories. In all cases where cultures were employed the commercial liquid rennet was used, in contrast to the use of homemade rennet alone. The Babcock test was used for fat determinations, and Hart's test for the casein. Samples of milk were taken just prior to the time milk was set with rennet. Cheeses were examined for glaesler condition about the time they were ready to ship. The records of the fat and casein relationship were made on milk during the months of July, August, and September in Ohio.

HOMEMADE RENNET CHEESE.

	Pounds of casein for 1 pound of fat in milk.							
	0.50 to 0.60	0.61 to 0.64	0.65 to 0.68	0.69 to 0.72	0.73 to 0.76	0.77 to 0.80	0.81 to 0.84	Above 0.84
Number of cheese	18	53	91	51	38	12	....	....
Per cent bad glaesler	38.85	9.43	8.79	0	2.63	0	....	....
Per cent total glaesler	77.70	45.26	25.27	7.84	13.15	8.33	....	....

EXTRACT RENNET AND CULTURE CHEESE.

	0.50 to 0.60	0.61 to 0.64	0.65 to 0.68	0.69 to 0.72	0.73 to 0.76	0.77 to 0.80	0.81 to 0.84	Above 0.84
Number of cheese	....	....	3	13	33	58	79	120
Per cent bad glaesler	....	....	0	7.69	9.09	1.72	0	.83
Per cent total glaesler	....	....	0	69.22	30.30	20.64	3.79	3.33

The above table gives results of both much and little glaesler quality in the cheese. The bad glaesler cheese would grade as No. 2, whereas the cheese showing little or only a trace were injured hardly enough to change the grading, but they are mentioned in this report, which accounts for the high percentage of glaesler cheese in the table.

Undoubtedly there are other factors that may cause glaesler cheese aside from a low casein-to-fat ratio. On the basis of several years' experience, however, we have found that failure to standardize the milk during the summer months has very often resulted in considerable glaesler cheese.

As a result of this investigation it seems advisable to standardize the milk during the warm summer months in the smaller factories so that it will have 0.72 of a pound of casein for every pound of fat, and with the rennet extract and culture cheese the milk should have 0.8 of a pound of casein for every pound of fat, assuming there is a loss of 0.9 to 1 per cent fat in the whey of the homemade rennet cheese and 0.6 to 0.7 per cent in the whey of the rennet extract and culture cheese.

RESULTS OF USING PURE CULTURES IN SWISS CHEESE MAKING.

Both the bulgaricus and the eye and flavor organisms have been used for pure cultures for several years in our factory at Grove City, which is under Government supervision. Gradually these cultures have been introduced into practically every large factory. Their introduction into larger factories is somewhat easier, as most of the larger plants employ trained bacteriologists to look after this work. Their introduction into the smaller factories has been somewhat slower, due to the fact that their use here requires more supervision. The cultures are sent either direct from the Dairy Division or from the agricultural college cooperating with the Federal department.

During the last year we have had two men supervising the use of the cultures, and working with a limited number of factories in Wisconsin and Ohio. At present there are about a dozen and a half of the smaller factories growing the cultures. The function of these men is not only to look after the propagation and handling of the starters, but to indicate the manner in which Swiss cheese should be made. Certain modifications in the manufacture and curing processes are necessary when these cultures are employed. Cultures are furnished only to those factories which are selected and which agree to carry out the instructions of the field agent. As a result of several years' experience in the manufacture of Swiss cheese, the improvement by the use of cultures may be summarized as follows: (1) Pure cultures require the use of commercial liquid rennet, which makes results more definite and uniform than where the stomach rennets are used. (2) The use of eye and flavor cultures makes it possible to open up the cheese without difficulty at all times of the year, in contrast with the irregular eye and flavor development for only part of the year found in nonculture factories. (3) Where the *Bacillus bulgaricus* has been employed we have never experienced any difficulty with the so-called "stinker" cheese, which has always occurred with the nonculture factories. (4) The employment of cultures in the manufacture of Swiss cheese has increased the price for the product as compared with the nonculture factories in the same locality.

THE EFFECT OF CENTRIFUGING MILK FOR THE MANUFACTURE OF SWISS CHEESE.

Aside from abnormal fermentations, the most common difficulty encountered by the Swiss cheese makers in this country is the overdevelopment of small eyes, or, as commonly expressed, the "over-setting" of the cheese. While studying the effect of agitation on eye formation in May, 1921, we found that by sending milk through a centrifuge this treatment tended to make fewer and larger eyes and reduced raggedness in eye formation to a minimum. Our first experiments were carried out on a laboratory scale. Later, 21 pairs of regular size Swiss cheeses were made at Grove City, Pa. Each pair of cheeses was made from the same milk, and the same method of manufacture was employed in both cases, with the exception that the milk for one cheese was centrifuged, while that for the other was untreated.

The results of centrifuging the milk for 21 cheeses were 16 fancy, 1 No. 1, and 4 niszlers, while the noncentrifuged milk gave 8 fancy and 13 No. 1. The percentage distribution was:

	Fancy grade.	No. 1 grade.	No. 2 grade.
	Per cent.	*Per cent.*	*Per cent.*
Cheese from centrifuged milk	76.2	4.8	19.0
Cheese from uncentrifuged milk	38.1	61.9	None.

The nature of the experiments necessitated the holding of milk for a considerable period of time, and thereby increased the tendency toward development of niszler cheese. The No. 2 cheese were genuine niszlers. That the increase in No. 2 cheese in the factory output was not so great as in the experimental cheese is shown by comparing the separated milk cheese over a period of several months, from December to June, inclusive. The milk for making this cheese was not mixed, as for the experimental cheese. The cheese made during the months of May and June was all sent through the separator, consequently the percentage of No. 2 cheese in the noncentrifuged-milk cheese was likely to be somewhat higher during these months, as the danger of No. 2 cheese is greater during that period. In fact, however, the proportion of the different grades was as follows:

Kind of cheese.	Number.	Grade.		
		Fancy.	No. 1.	No. 2.
		Per cent.	*Per cent.*	*Per cent.*
From centrifuged milk	241	77.6	7.1	15.3
From uncentrifuged milk	109	30.3	52.3	17.4

The figures indicate that the percentage of fancy cheese was greatly increased, that of No. 1 was reduced, and that of No. 2 cheese was also somewhat reduced in the centrifuged-milk cheese. The effect of centrifuging upon the quality of Swiss cheese is illustrated in Figures 1, 2, 3, and 4. The first two cheeses were made from centrifuged milk, while the last two were made from uncentrifuged milk. Each pair of cheeses was made from the same milk and the same methods of manufacture were employed in both cases. Centrifuging the milk for Swiss cheese reduces the number of eyes and increases their size.

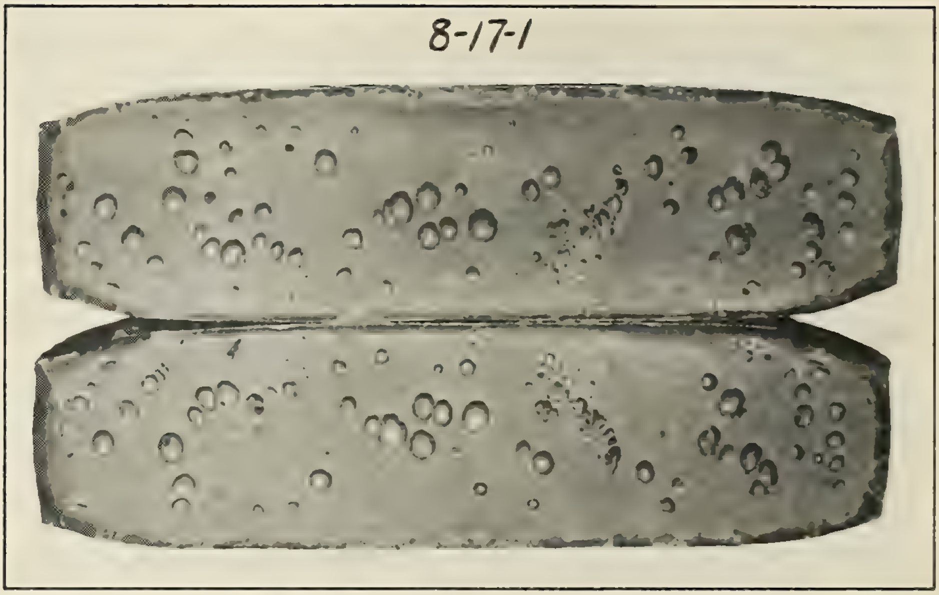

FIG. 1.—Cheese from first lot of centrifuged milk.

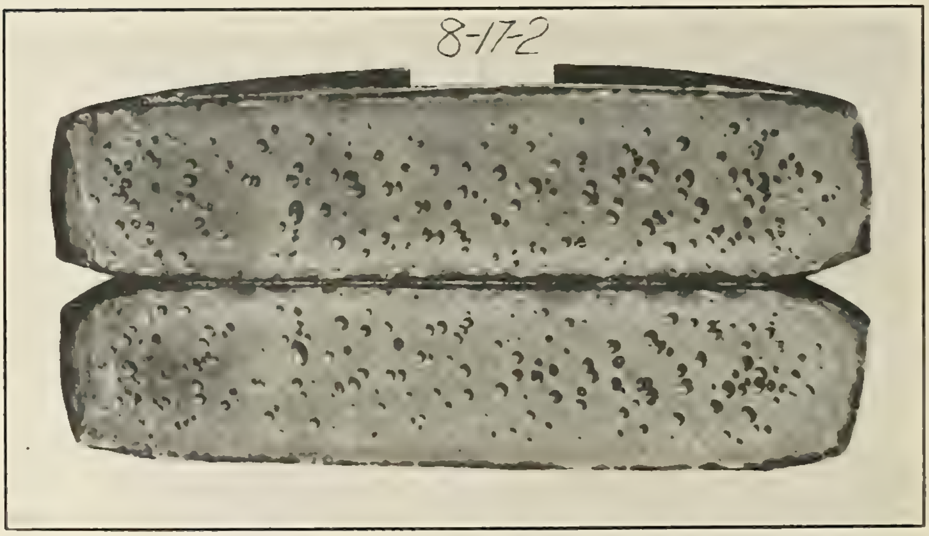

FIG. 2.—Cheese from first lot of milk not centrifuged.

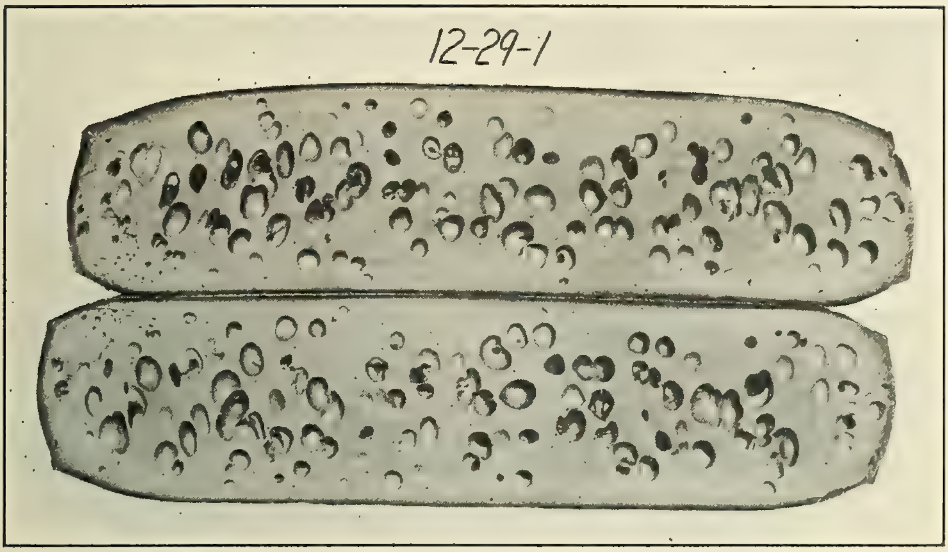

FIG. 3.—Cheese from second lot of centrifuged milk.

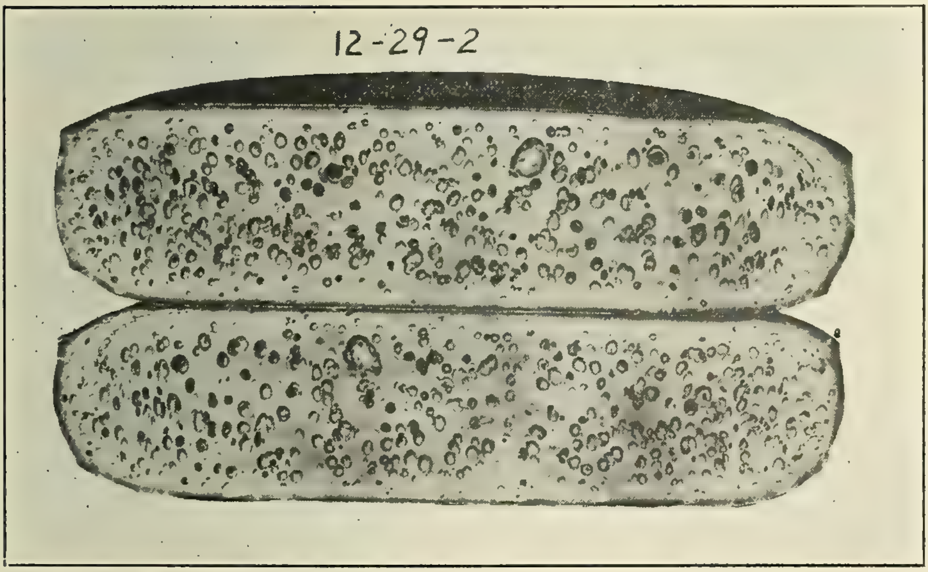

FIG. 4.—Cheese from second lot of milk not centrifuged.

From the examination of many experimental cheeses it appears that this treatment does not influence the flavor to any appreciable extent if at all. The body of the cheese is more firm than where the cheese is made in the usual manner. There are cases where this treatment fails to show improvement; in most cases, however, the results are extremely gratifying. The cause of this improvement in Swiss cheese might be one of several things, but as far as our observations show the improvement seems to be due to the removal of dirt or other cellular elements from the milk.

In initial attempts to manufacture cheese from centrifuged milk difficulty was experienced with niszler cheese, due to the fact that it was necessary to hold the milk at a high temperature for a considerable period of time prior to centrifuging. However, this difficulty has been overcome by cooling the milk. This spring 20 centrifuged cheeses were made without a niszler or No. 2 cheese.

In the small factories which receive their milk while it is still warm, the problem of making cheese by this process is more difficult. These difficulties may be specified as follows:

1. Centrifuging the milk requires extra labor, time, and expense.
2. Warm milk appears more subject to foaming and the niszler fermentation.
3. Very few factories are provided with suitable facilities for cooling and holding the milk.

Despite these difficulties, several factories have had good success by this treatment. One of our Swiss cheese specialists in Wisconsin reports that from July 29 to September 8, when this treatment was given trial, there was but one No. 2 cheese, and 70 per cent of the remainder were fancy. The factories received from 3 to 5 cents more per pound for the treated than for the untreated cheese, and the centrifuged-milk cheese had fewer and larger eyes than the untreated cheese. The centrifuged cheese during the last year has won first prizes at the cheese exhibits of Wisconsin and Ohio.

THE INFLUENCE OF SECONDARY HEATING ON GAS FORMATION IN SWISS CHEESE.

Orla-Jensen, in working with Swiss cheese, found that there was less danger of niszler and pressler cheese when the higher cooking temperatures were employed. His comparisons, however, were based on cheese made on one day compared with that made on another day.

In order to study the effect of high heat in suppressing gas, cheese was made by inoculating milk with definite quantities of liquid culture of a coli-aerogenes type originally isolated from an inflated cheese. Thus two cheeses were made daily in the same manner, from the same milk, with the single exception of a variation in the cooking temperature. Approximately 300 pounds of milk were employed for each cheese. The temperature in each kettle was carefully watched; the final cooking temperature probably did not vary 0.5° C., as a cheese maker was stationed at each kettle so that the temperature could be carefully regulated.

Normally about 0.5 per cent of the bulgaricus culture is used. In order to make the difference in cooking temperature more pronounced, 0.1 per cent of bulgaricus was used in conjunction with

1,000 cubic centimeters of the gas-producing organism. When a cooking temperature of 52° was compared with 55° C., a distinct difference was noted. In some cases where the curd was cooked to 52° C. the cheese would show niszler or pressler tendencies on the surface of the cheese, while at other times indications of gas occurred throughout the cheese, whereas the cheese cooked to 55° would seldom show indications of gas.

Somewhat similar results were observed when 0.5 per cent of bulgaricus was employed in conjunction with 3,000 cubic centimeters of the gas-producing organism. Figure 5 shows the effect of high heat in controlling the fermentation.

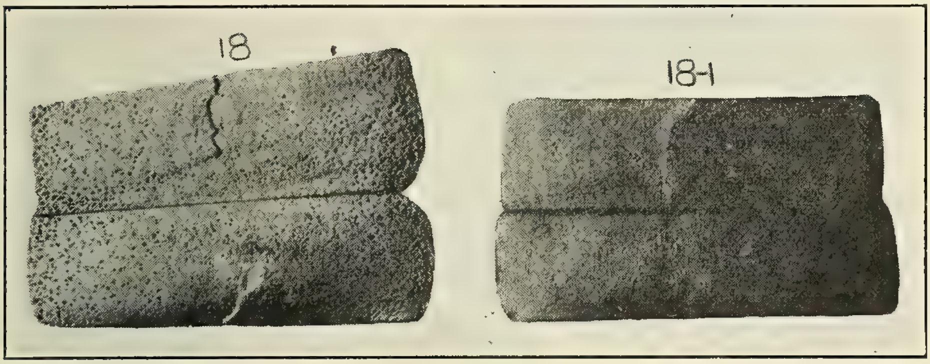

FIG. 5.—Influence of high heat on uality of Swiss cheese. (18) Cheese cooked to 52° C. (18–1) Cheese cooked to 55° C.

This is a cheese cut the day after making. Cheese 18 was cooked to 52° C., whereas cheese 18–1 was cooked to 55° C.

There have been very few cases in our experience where the use of a high cooking temperature has checked niszler trouble in the field. However, the results of our experiments in the laboratory with the use of high cooking temperatures and gas-producing organisms of the coli-aerogenes type has led us to believe that there is some advantage to be gained by the use of a high secondary cooking temperature.

THE USE OF OXYGEN IN THE MANUFACTURE OF SWISS CHEESE.

The gassy fermentation commonly known as "niszler cheese" causes a loss of several hundred thousand dollars annually, and is the most serious difficulty that confronts the manufacturer of Swiss cheese in the United States. Some factories do not have more than half a dozen niszler cheeses during the entire season, but others run as high as 50 per cent during certain months. During the last year the percentage of niszler cheese in six culture factories in Ohio averaged 7.4 per cent on the basis of 2,463 cheese made. Incomplete figures for the present year indicate that the percentage of niszler cheese will be considerably lower than last year.

While conducting some filtering experiments in which we passed milk through several layers of cotton, it was observed that the cheese made from milk so treated was normal, whereas the cheese made from the same milk untreated became inflated. We failed to get the same results upon repeating the experiment; however, the first experiment led us to the opinion that possibly the beneficial results were from the aeration received. In making Cheddar cheese, it is recalled, when gas is in evidence it is the custom to stir, air, and pile the curd until the gas disappears. One book, in the discussion of gassy curd, says: "This shows that the gas-producing organisms have weakened and will not cause any more holes." It occurred to us that by treating the milk known to be subject to a gassy fermentation with oxygen we might overcome that fermentation.

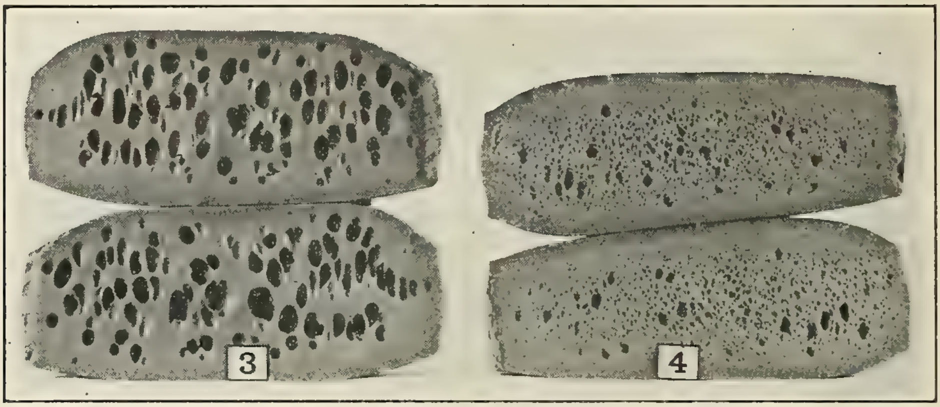

Fig. 6.—First pair of cheeses showing effect of oxygen upon quality of Swiss cheese. (3) Treated with oxygen. (4) Not treated with oxygen.

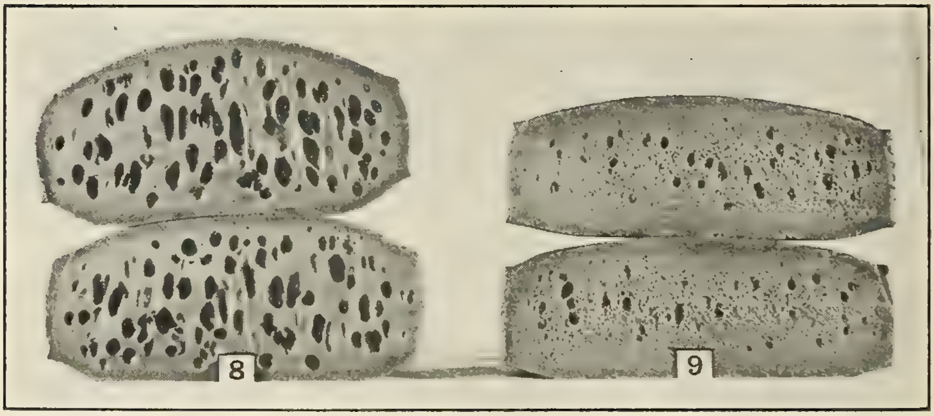

Fig. 7.—Second pair of cheeses showing effect of oxygen upon quality of Swiss cheese. (8) Treated with oxygen. (9) Not treated with oxygen.

With this purpose in view, we added a pure culture of a vigorous gas-producing spore-forming anaerobe to milk, and then treated one-half of it with ozone. The organism used was isolated from a typical niszler cheese and when added to milk in sufficient quantities the development of gas could not be checked by high heat nor by any other means known to us. By this treatment we succeeded fairly well in checking this fermentation in our preliminary work with ozone· However, the use of ozone, though it had no apparent injurious effect upon eye formation, did seem responsible for the strong disagreeable flavor in the cheese so treated.

We next tried the use of oxygen, with favorable results. It was found that if oxygen was run directly into milk which had previously been inoculated with the gas-producing organism, used in the above experiment, the development of gas could be either completely checked or nearly so. About 20 cubic feet of oxygen was run into the milk by means of a glass tube to which a perforated copper coil was attached. The temperature of the milk was from 10° to 15° C.

In the check cheese which was not treated with oxygen, difficulty was experienced in getting a niszler effect throughout, though a niszler or pressler tendency would often be in evidence along the edge of the cheese. In some cases the difference between the cheeses from treated and untreated milk was very marked, as is shown in cheeses 3 and 4, 8 and 9, Figures 6 and 7. Cheeses 3 and 8 were treated with oxygen, whereas cheeses 4 and 9 were not treated with oxygen. The two cheeses in each pair were made from the same milk, to which 1,000 cubic centimeters of gas-producing organisms had been added. All the cheeses were made by the same method with the exception that in cheeses 3 and 8 oxygen was added, while in cheeses 4 and 9 no oxygen was added.

In most cases from 300 to 500 pounds of milk were employed in the making of each cheese. In some cases the cheese was cut for examination the day after making; in other cases the cheese was allowed to ripen three or four months before examination, as was the case with the cheese in Figures 6 and 7. The use of oxygen did not injure the flavor of the cheese in any way, nor did it appear to have any appreciable effect upon the setting of the cheese. If there was any change it was slightly in favor of the oxygen treatment. The action of the oxygen as indicated by dilution tests seems to be inhibitory rather than actually destructive of the gas organisms. It seems, however, that the gas-producing organisms are merely held in check, whereas the lactobacilli develop normally.

The commercial possibilities of the oxygen treatment have not been fully tested. We have made a few cheeses on a factory scale, but with no satisfactory checks. Whether or not old milk or milk subject to the niszler fermentation can be utilized by means of this treatment remains a question. It will be necessary to make cheese over a long period from mixed milk, giving suitable checks, before definite conclusions can be drawn. The oxygen treatment, however, has given us the only laboratory results that have offered any hope that this type of anærobic fermentation may be controlled in Swiss cheese.

Chairman Sammis. This has been a very interesting subject, and I think there probably are some questions.

Mr. C. J. Monrad (Little Falls, N. Y.). What I would like to ask is information regarding the flavoring by ozone.

Mr. Matheson. We found that it gave us more off flavor probably from the fat, and we did not follow it up much further, but thought we could do just as well by oxygen. We just made a few cheeses by that method, but hope to continue by that treatment, and by using a smaller quantity we might be able to get around the off flavor.

Mr. Geo. E. Fertig (Deis-Fertig Dairies Co., Dover, Ohio). In the process with oxygen, do you change your temperature?

Mr. Matheson. It is true a lower temperature will hold a higher percentage of oxygen. The milk we were using for our experiments was cooled probably to 13° or 14° C. at the time of using it. I think it is quite possible to use a considerably higher temperature than the temperature that we have used. I do not think there is any question about that, although it would be probably more expensive to use a lower temperature for the introduction of oxygen.

Chairman Sammis. On our program this afternoon there are a number of papers which have been prepared by authors who were not expected to be present. We also have one other paper, "The flora of American commercial Cheddar cheese and its relation to quality," by G. J. Hucker, associate in research, New York State Agricultural Experiment Station, Geneva, N. Y. I hope Doctor Hucker is here, or will send some one to go into this subject.

There is another paper which has just been added to the program by Dr. Masayoshi Sato, professor of Hokkaido Imperial University, at Sapporo, Japan, on the subject "Mongolian cheese or 'Naii Tofu.'" We will perhaps hear from Doctor Sato later on.

Among the other papers which have been sent in, the audience has its choice as to which one of these should be read and discussed. Among those we have present with us is Dr. G. Koestler, chief, chemical division, Liebefeld Experiment Station, Bern, Switzerland, and the subject of his paper is "Some milk types characterized by their rennin reaction and their importance in cheese making."

SOME MILK TYPES CHARACTERIZED BY THEIR RENNIN REACTION AND THEIR IMPORTANCE IN CHEESE MAKING.

G. Koestler, Ph. D., chief, chemical division, Swiss Dairy and Bacteriological Research Station, Liebefeld, Bern, Switzerland.

I would like to describe briefly three different types of milk which do not coagulate with rennet in a desirable manner:

(1) Type A, which is in Switzerland known under the name of "Rassalzige" milk (highly salty milk). We know that this kind of milk is caused by more or less severe catarrhal inflammation of the udder glands, and that bacteria can remain a long time in the udder; in the latter case we have generally a chronic inflammation of the udder; the milk obtains a salty taste. For cheese making this kind of milk is very dangerous (causing "stinker," or putrid cheese).

(2) Type B, which does not coagulate with rennet, seems chemically not changed at all. This kind of milk will be normal when we add a certain amount of good milk. Van Dam has studied this type of milk and he states that this milk has not enough of colloidal calcium (calcium combined with casein, "caseinate").

(3) Type C has already caused serious trouble in cheese making in Switzerland. This kind of milk coagulates with rennet often at the right time, but the coagulum remains tender or weak during the manufacturing process.

In this case the cheese maker is forced to spend more time in the working of this cheese curd, more than twice as long as with normal milk. For this reason, the cheese does not ripen well because it does not have the proper texture; this can influence the fermentation in an undesirable way. This kind of milk can be found in some dairies in a remarkably great amount. It is more than curious that we find this trouble in the secretion in two generations of cows (mother and daughters). Even 5 per cent of this milk mixed with good milk has a disadvantageous influence on the quality of our Emmental cheese. Recently we have studied six cases of this kind of trouble in cheese making and have found that type C was the real cause of the trouble. It may be said that this type of milk is difficult to detect because the chemical content is practically the same as that of good milk. We can only find out this milk when a rennet test is made, and in this test we must not only look to the time necessary for coagulation but also to the time of matting and the texture of the mat.

In closing I want to draw your attention to the fact that in the State of Wisconsin all the makers of Swiss cheese complain that the milk (especially that from silage-fed cows) will not coagulate in the desired manner. I do not know to what degree this is true, but according to our experiments and knowledge the last type of milk, type C, can be found coming from cows which are in the full period of lactation, and the first-named type of milk, type A, is often secreted by cows which are forced to an exceptionaly high milk production.

Chairman SAMMIS. Is there any discussion of this paper? I am sure it has been of interest to us, and we shall be glad to hear any questions there might be on this subject.

Sir ARNOLD THEILER. He speaks of the salty milk coming from an udder which is inflamed. Is that right?

Doctor KOESTLER. The milk comes from cows in which the glands of the udder are inflamed.

Sir ARNOLD THEILER. We recognize three distinct types of inflammation of the udder. Do you, perhaps, know which particular type this is?

Doctor KOESTLER. I spoke only of the types of milk which we take for cheese making, but there are other kinds of inflammation where we do not take the milk, but in this particular case the bacteria are settled in the glands of the udder.

Chairman SAMMIS. Is there any further discussion?

I see among the audience several faces of those whom I am sure you would like to hear from. I see Prof. A. Peter, director of the Government Dairy School and professor of dairying in the Federal Technical High School, of Zurich, Switzerland. In addition to that he is a great economist. We will be very glad to hear a few words from Professor Peter. [Applause.]

Prof. A. PETER (Rütti-Zollikofen, Switzerland). Mr. President and gentlemen: I have been quite familiar with this cheese question for 20 years. When I went to the technical school I first worked on the bacteriology and the chemical side of our cheese making. Professor Burri, our honorary chairman, was then my instructor in bacteriology, and I worked with him along that line. Then I became a director of the dairy school and had to organize an inspection of our cheese factories. I had to go out into the cheese factories to see what might be the origin of the different problems the practical cheese maker has to solve in his work. In this work I always noted that the first condition was to have a sound milk that came from a sound cow with a sound udder. I studied that milk that Doctor Koestler has now become an expert on, the salty milk. I am very familiar with it from the standpoint of a common interest. We want the cheese makers of Switzerland to bring in the defective milk.

These inspectors go out among the farmers and look after the cows and tell the farmers what this cow has or what that cow has, and we are very much indebted to Doctor Koestler for the work he has accomplished along that particular line. He now has the factories producing cheese in a good, scientific manner. His work is very important to the practical cheese maker. The inspectors are paid by the dairy organizations. The dairy association pays one-third, the district government is paying one-third, and the department is paying one-third of the cost. These inspectors go out early in the morning before the farmers bring the milk in to see what rennin or culture this cheese maker is using. When the work in the factory is done they go around to the farmers to see if they have healthy cows, if they are feeding the cows properly, if they are milking them properly and if they are handling the milk properly. These inspectors are very good, very important, and their work is indispensable to the cheese maker, and the cheese maker is very glad for the work they are doing. I thank you. [Applause.]

Chairman Sammis. We will have the pleasure of hearing a brief abstract of the paper that was to have been read by Mr. Hucker.

(Dr. Breed gave a brief abstract of Mr. Hucker's paper.)

Chairman Sammis. Are there any of the remaining papers listed for this session that you wish read for the purpose of discussion? They will be read by title.

(Adjournment.)

(Papers read by title):

THE FLORA OF AMERICAN COMMERCIAL CHEDDAR CHEESE AND ITS RELATION TO QUALITY.

G. J. Hucker, New York Agricultural Experiment Station, Geneva, N. Y.

It is a well-established fact that the ultimate flavor and quality of cheese are dependent largely upon the action of certain microorganisms which are found living either within the curd or on its surface during the ripening process. Any desired change in the character of the ripened product must be secured either by insuring the introduction of the proper kinds of organisms during the manufacture or ripening, or by such manipulation of the curd or ripening cheese as to allow the desirable flora to gain an ascendency over the large number of miscellaneous inert or undesirable types which may be present.

In the manufacture of many of the so-called soft cheeses a combination of both of these procedures is followed, the desired organisms being added in sufficient numbers to practically overgrow all other types normally occurring in the milk, thus giving the characteristic texture and flavor which may be found, for example, in Camembert, Brie, etc. In all such cases, the type of cheese secured is dependent entirely upon the kind of organism introduced. The work of Thom, Mazé, and many others has made such procedure possible by a study of the kinds of organisms found in the ripening cheese, with a result that various molds, bacteria, etc., are now known which under certain conditions have the power to produce the desired results.

Similar methods have been followed in the production of high-grade Emmental cheese. In this instance, certain organisms, as studied by Freudenreich, Jensen, Burri, and Sherman, have been found definitely associated with the development of the characteristic flavor which, in this case, is probably closely allied with the production of the so-called eyes. Certain of the lactobacilli and propionic acid organisms have been shown by the above investigators to produce desirable results if properly handled and introduced during the process of manufacture. In certain varieties of Italian cheese (grana) Gorini has found that better grades of cheese are usually associated with a group of acid proteolytic cocci, the action of which upon the curd is responsible for the improved quality of the ripened cheese.

In the case of Cheddar cheese, and the same is true of other varieties, the flora of the ripening curd plays a large rôle in the production of a desirable or undesirable product. The only control upon this flora which has been used in practice has been the addition of lactic acid starters (*Strep. lactis*) and the curing of the cheese under conditions of temperature, moisture, etc., which have been found by years of practice to give the most desirable results. Following such a procedure, it is evident that the ultimate quality of the ripened product depends largely upon the flora of the milk to be made into cheese. Improvement in the quality of American Cheddar cheese can be brought about either by producing milk which contains as few organisms as possible, the desired flora being added as a starter, or, better, by certain manipulations in the dairy to produce milk which will contain the proper flora for the insurance of Cheddar cheese of a high quality. To follow either of these procedures successfully, more should be known regarding the flora of Cheddar cheese and the relation of such flora to its quality. With such information at hand it becomes necessary to determine which groups of organisms are associated with the better grades of Cheddar cheese and which are characteristic and probably accountable for the large amount of poor-quality cheese found in our local markets.

In previous studies on the flora of American Cheddar cheese, Harding and Prucha, at the New York Agricultural Experiment Station, and Russell, at the Wisconsin Experiment Station, concluded that *Bacterium lactis acidi* was the predominating organism in the earlier stages of the ripening; while later the Department of Agriculture, at Washington, and the Wisconsin Experiment Station pointed out that, although *B. lactis acidi* (*S. lactis*) was present in large numbers in the earlier stages, it is replaced in the later curing by the lactobacilli group which, in the final periods, are the predominating types. In both of these investigations only cheese of high quality was used, as the aim of the investigations was to determine the flora during the ripening of Cheddar cheese of good quality.

Recently the New York Agricultural Experiment Station[1] has again undertaken a general floral study of Cheddar cheese, which covered a wide variety of samples obtained from a number of sources.

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[1] See N. Y. Agr. Exp. Sta. Tech. Bul. No. 90, 1922.

The samples were taken from cheese of very inferior quality and also from the better grades, with the thought that the results might give some indications as to the groups of organisms to be avoided, as well as the desirable type. The samples, 40 in all, from 25 or more factories, as purchased from the local stores, were plated by the usual methods and also sectioned with the microtome. The predominating groups were studied culturally and microscopically. In all, 265 cultures were isolated from the 40 samples. The cheeses were, previous to examination, classified into three general groups from the standpoint of flavor, texture, and general quality. The cultures isolated were taken from the plates in such a manner as to indicate the relative abundance of any particular type in any sample.

The cultures were subjected to the usual laboratory tests and classified into the following groups: (*a*) Spore formers; (*b*) gram-negative rods; (*c*) lactobacilli; (*d*) *Streptococcus lactis* (Lister) Löhnis; (*e*) cocci; (*f*) streptococci other than *S. lactis*, and (*g*) yeasts.

The spore formers have been mentioned in the previous literature by Duclaux as being a factor in the ripening of cheese; and in the present work the group was found to predominate in the more undesirable grades. Of the 265 cultures isolated, 54 were spore formers, and from the standpoint of numbers they were the largest group isolated. As stated above, other workers used only high-grade cheese in floral work, and did not at the completion of the work draw conclusions as to the undesirable types, but rather as to the types that normally existed in the high grades of cheese. Of the cultures from the better or "above average" grade of cheese, only 9 per cent were spore formers, a small percentage in relation to other groups. As the quality of the cheese became of a lower type the number of spore formers increased. Although the rods which produce spores usually attack casein and render it soluble, the products resulting apparently have an undesirable effect upon flavor.

Of the coccus types studied (27 strains in all) 20 were white, and 6 yellow, while only 1 produced an orange pigment. The cheese of all grades contained approximately the same proportionate number of cocci, and no correlation was found to exist between the quality of the cheese and the number of cocci present. This group, however, may play a large part in the ripening changes, as microscopic preparations made from cheese which has partially ripened show large colonies of cocci in dense masses throughout the cheese, indicating that the coccus types have grown, reproduced, and attacked the surrounding medium for their food supply.

Of the 265 cultures isolated, only 26 were streptococci (other than *S. lactis*). The greater number of these were derived from the poorer grades, and only one culture from the better grade of cheese. Probably this group is the least abundant of all types in cheese, and if it plays an important part in the ripening it no doubt attacks the casein in conjunction with some other group. This fact was indicated in the floral work of Miss Evans, at Washington, who found that certain types of streptococci when used as a starter with other types affected the development of flavor appreciably.

The group of gram-negative rods included such types as attack lactose and nearly all liquefy gelatin. This group includes organisms of the colon and proteus types. In abundance they are second only to the spore-forming group as 52 of the 265 cultures belonged in this class. The action of this group on the ripening is generally regarded as detrimental, and their presence accounts for gas and undesirable flavors in the poorer quality of cheese.

The lactobacilli (*Bacterium casei*, *B. bulgaricus*, etc.) are one of the most important groups involved in the ripening changes of Cheddar cheese. Other types of cheese, as Emmental, Edam, Parmesan, etc., contain large numbers of these organisms and no doubt in all of these cases the lactobacilli play a part in their curing. This group is characterized by gram-positive rods of various lengths, usually long. Nearly all types stain deeply with methylene blue, while a few stain with distinct granules. The group is present in milk in small numbers and develops rapidly in the cheese after the first few days in the curing room, gradually replacing other types. Four distinct strains are recognized by Freudenreich, divided on their staining reactions, action upon milk, and morphology. In all cases where this group has been studied in relation to cheese ripening, it has been found that they are largely responsible for the development of the flavor, and also play a part in the breaking down of the casein. In the above work it was noted that the cheese classed as above average contained the largest number of lactobacilli, while the inferior grades contained fewer numbers. Of the cheese "above average" 30 per cent of the cultures were lactobacilli, while 21 per cent of the "average" and 14 per cent of the cheese "below average" belonged to this group.

More has been written on *S. lactis* and its relation to Cheddar-cheese ripening than on any other of the common cheese organisms. Russell, at Wisconsin, in 1904, pointed out that this organism is present in large numbers in the early stages of the ripening, and he concluded that it plays a principal rôle in the ripening. More recent work has shown that the part played by organisms of the *S. lactis* type is primarily that of changing the sugars into lactic acid. The acid furnishes a medium for the development of other and more important groups. The predominance of organisms of this type during the first few days of curing is due largely to the addition of *S. lactis* starters in the milk previous to cheese making. In the present work, only 29 cultures were isolated. This does not give a fair representation of the conditions which actually exist, as the age of these samples was such that these organisms had largely disappeared.

Such a few cultures of yeast were found, three in number, that the group has not been considered in this paper in their relation to cheese quality. Of the three strains, two were isolated from the better class of cheese. Since the completion of the above survey, however, a cheese of poor quality, purchased on the open market, has been examined and found to contain a predominating yeast flora.

The floral changes in a typical American Cheddar cheese can be summarized by saying that in the early stages the organisms of the *S. lactis* type develop rapidly. In the better-quality cheese, the lactobacilli, cocci, and streptococci develop in the later stages until the fourth or fifth month, when the number of organisms diminishes. In the poorer grades of cheese the sporeformers and gram-negative rods develop after the initial predominance of *S. lactis.*

PASTEURIZATION OF MILK FOR CHEDDAR CHEESE MAKING IN NEW ZEALAND.

CHAS. STEVENSON, dairy instructor, Department of Agriculture, New Plymouth, New Zealand.

The question of the quality of milk intended for cheese making is one which has for many years exercised the minds of those engaged in the industry in New Zealand. It is well known that the condition in which the milk is delivered to the factories is the chief factor governing the quality of the cheese produced. If all the milk delivered was up to the standard of the best quality, no difficulty would be experienced in producing a uniformly good quality of cheese. Unfortunately, in almost every district we find some dairy farmers who do not study the production of milk from a sanitary point of view, with the result that milk of such varying qualities is delivered that the production of a uniform quality of cheese from day to day is found to be almost impossible.

In view of the success achieved in the Pasteurization of cream for butter making, the attention of cheese makers was directed to the possibility of adopting the same system with regard to milk required for cheese making as a means of overcoming these difficulties. Many experiments were carried out in the Pasteurization of milk used for cheese making, but only limited quantities were treated. Sufficient data were obtained, however, to indicate that the quality of the cheese was improved to such an extent as to warrant further steps being taken. For some time it was found impossible to make much progress along this line, owing to the fact that machinery capable of heating large quantities of milk in a limited time was not available, but with the introduction of regenerative heaters this difficulty was eventually overcome.

These machines, which are of Danish manufacture, were first imported into this country in the year 1914, and are made in different sizes, with a capacity varying from 800 to 1,800 gallons of milk per hour, while heating to a temperature of 160° to 165° F. When working these heaters at full capacity, a transference of heat ranging from 40° to 45° F. is made from the hot to the cold milk. Most of the machines in use here are of the larger type, and all are fitted with a steam inlet sufficiently large to utilize exhaust steam where available. A complete plant, which consists of a milk-receiving vat, a regenerator, two milk pumps, and a large cooler, will occupy a floor space of 20 feet long by 12 to 14 feet wide, and can be installed to-day at a cost of £365. All necessary piping is made of the best drawn brass, tinned and fitted in short lengths, and jointed with brass unions. The coolers found most suitable for this work are those of the horizontal tubular type, 12 feet long by 4 feet high, fitted with two water inlets and a like number of discharges.

The supply of water for cooling purposes presents practically no difficulty, as the milk leaves the regenerator at a temperature of 115° to 120° F., and requires only to be further cooled to 86° or 90° F. Many dairy companies have adopted the practice of pumping the waste water from the cooler to storage tanks and using this water again for ordinary factory purposes. By this method Pasteurization places no extra claim on the water supply.

Observations made over a number of years indicate that where live steam only is used for Pasteurization, the increase in fuel consumption is from 10 to 15 per cent, but where exhaust steam is also used practically no increase is shown. In order to carry on this work successfully, and as economically as possible, a plentiful supply of dry steam is necessary. Where the larger Pasteurizing plants are installed a steam boiler of at least 20 horsepower is required.

The manufacture of cheese from Pasteurized milk presents no difficulty whatever to the experienced cheese maker; in fact, in handling this class of milk, which after careful Pasteurization is in practically the same uniform condition from day to day, the work is considerably simplified. Perhaps the most important point to be observed is the maintenance of an even temperature. Practically all the most serious defects found in this class of cheese have been traced to lack of care during the heating process. A temperature of from 160° to 165° F. is generally aimed at, and with reasonable care no difficulty is experienced in maintaining a temperature within these limits. If the temperature of the milk be permitted to fall below 160° F. the flavor of the cheese is deteriorated, and, on the other hand, if it rises much above 165° F. the body and texture are invariably injured, the result being a mealy bodied cheese.

A good-quality starter is essential, and this, applied at the rate of 1 to 1¼ per cent, has been found to give excellent results. During the earlier stages of this work in New Zealand a quantity of hydrochloric acid was added to the milk after Pasteurization, but close observation indicated that this practice was of no assistance, and consequently it has now been abandoned. In dealing with Pasteurized, as against un-Pasteurized, milk for cheese making, it has been found necessary to increase the amount of rennet used. An increase of approximately ½ ounce per 1,000 pounds of milk is sufficient to produce a good coagulation.

Among the many advantages claimed for this method of cheese manufacture, perhaps the general improvement in quality is the most important. Numerous instances could be given where the average grade of cheese coming forward from different factories has risen to the extent of two or three points after the installation of a Pasteurizing plant, and at all factories where the work is carefully carried out second-grade cheese has been entirely eliminated. During the years 1915 to 1917, owing to the inadequacy of shipping facilities, it became necessary to store cheese here for lengthy periods; and at that time the superior keeping qualities of the cheese made from Pasteurized milk were most outstanding.

At different stages during the process of cheese manufacture losses of fat are observed, but these losses are considerably decreased when the milk is Pasteurized. One of the chief difficulties of this kind, the working of slightly overripe milk, is completely overcome by the Pasteurization method of manufacture. Careful observation has shown that the loss of fat in the whey is, on an average, 0.05 less with Pasteurized than with un-Pasteurized milk. This reduction or elimination of the losses, together with the general improvement in the quality of the cheese, proves clearly that from an economic point of view, the question of installing

Pasteurizing plants in cheese factories is one which is well worthy of the earnest consideration of those engaged in the industry.

Although it has not yet been considered expedient to introduce legislation making compulsory the Pasteurization of milk for cheese making, every opportunity has been taken by officers of the dairy division of New Zealand to place before the dairy companies concerned the advantages of the system, and the progress made is indicated by the large number of plants which have been installed since the inception of this system.

Prior to the year 1914 the manufacture of Cheddar cheese from Pasteurized milk was practically unknown in New Zealand, while to-day a total of 38,000 tons of cheese, approximately two-thirds of the output of the whole Dominion, is made by this system. During the past three years developments have been somewhat retarded owing to the great increase—practically 100 per cent—which has taken place in the cost of the necessary machinery. Prices are now returning to normal, however, and further progress in this connection is therefore assured.

The experience gained during the past seven years proves conclusively that the adoption of the system of Pasteurization as applied to milk used for Cheddar-cheese making in New Zealand has been an unqualified success, and it is confidently anticipated that in a short time the system will be in operation in all the cheese factories in the Dominion.

RELATION OF LACTIC BACTERIA TO CHEESE RIPENING.

Constantino Gorini, Ph. D., director of the bacteriological laboratory of the Agricultural High School, Milan, Italy.

In response to the invitation of the committee on research and education of the World's Dairy Congress, I take pleasure in reviewing briefly the contribution which I have made to the question of lactic ferments in connection with cheese ripening.

My scientific researches and practical experiments have shown that two types of lactic ferments are concerned in cheese ripening; first, the ferments pointed out by Freudenreich, which do not attack casein in an acid reaction (simple lactic ferments); second, the ferments indicated by me, which attack casein even in an acid medium (acidoproteolytic ferments).

I was led to the discovery of this second type of ferments after I demonstrated in the year 1892 that the *Bacillus prodigiosus* clots milk by a double means, by acidity and by rennin, later dissolving the curd with an acid reaction. This was the first example of an acidoproteolytic bacterium. In 1894 I showed that three other species of bacteria acted in the same manner: *Bacillus indicus*, *Proteus mirabilis*, and the *Ascobacillus citreus*, a true milk bacterium. At that time I proposed to add to the lactic ferments already known a new type, acidoproteolytic ferments, advancing the hypothesis that they contribute to the ripening of cheese.

In 1897 I further demonstrated that the saccharolytic and proteolytic activities of bacteria living in milk are dependent upon environmental conditions; thus low temperature and aerobiosis favor caseolysis, while high temperature and anaerobiosis favor saccharolysis.

My works, although published in French and German reviews, remained almost unnoticed until in 1901 I went to work with Mr. Freudenreich in the Swiss Federal Laboratory for Dairy Bacteriology, of Liebefeld, Bern, where I showed that among the microscopic flora of the normal udder cocci exist which are specifically acidoproteolytic. I was therefore justified in reexpressing my views upon their rôle and importance in the ripening of cheese, where, in fact, I have also found them. It was only then that, as a result of my studies, closely followed by Freudenreich and also by Orla-Jensen and Gerda Troili-Petersson (both at that time with me in Liebefeld), that these investigators undertook a closer examination of the cheese-inhabiting cocci, which up to that time Freudenreich had classified as *Micrococcus casei liquefaciens*, basing his classification only on the liquefaction of gelatine, since he had then not observed their action in casein. However that may be, it is positive that it was only after my investigations that Freudenreich and Orla-Jensen have paid attention to liquefying cocci and have admitted that some other group of bacteria was working in symbiotic relationship with *Bacillus casei* ε and producing proteolytic enzymes.

It was not long before Burri, Boekhout, and DeVries confirmed my findings.

For some time it has been stated that these cocci are of limited importance, since they disappear rather rapidly from the loaf of Emmental cheese; but I have pointed out that, even if this were true, the action of their caseolytic enzymes remains and continues even after the death of the cells, and, furthermore, that such an early disappearance (due, perhaps, to the high temperature of cooking) can not be proved in all types of cheese, for example, by means of my method of microscopic examination of sectioned cheese I have found this coccus in Parmesan or grana after several months, and it is the same in Cheddar, according to Hastings, Hart, Flint, and Hucker; in Tilsit, according to Grimmer; in Edam, according to Boekhout, etc. I add that these cocci and their enzymes work also at the low temperatures of cheese ripening. These facts were later corroborated with regard to the Cheddar type, ripened at 23° C., where bacteria disappear far more rapidly than in the types allowed to ripen at lower temperatures (8° to 12° C.), while at the same time the amid content continues to increase even after the bacteria have almost been destroyed (Rogers). To this should be added the fact that to these organisms should also be attributed, probably the production of the endomammary galactase; this is a so-called natural proteolytic enzyme first discovered by Babcock and Russell in 1897. This was before my demonstration of the existence of acidoproteolytic cocci in the mammary flora and also before my statements purporting to draw attention to the possibility that milk could be drawn already heavily charged with cocci and the rennin derived therefrom, so as to yield the phenomenon of premature coagulation. This occurrence I ascribed chiefly to stagnations of the milk or to some altered functions of the mammae even without the accompaniment of evident morbid inflammatory processes. It is a known fact that Babcock and Russell and later Orla-Jensen and many other investigators have attributed to galactase important functions in the digestion of casein in hard as well as in soft cheese.

It has been objected also that the cocci of the udder are different from those of cheese; but already in 1902 I have shown that the mammary cocci are of two kinds, one which liquefies gelatine and one which does not; however, I have noted that intermediate types exist and that the passage from one to another is easy, since they are very variable in form and function. I found the same thing to be true in the cocci of cheese, whose two principal types I have described under the names *Micrococcus casei acidoproteolyticus* I (gelatine liquefier) and II (gelatine nonliquefier). This variability has since been found by various authors (Grimmer, Hucker, etc.). Thus the objection becomes untenable.

In continuation of my work of 1897 I have further shown that the verification of the acidoproteolytic properties of lactic ferments is not always easy, for their saccharolytic and proteolytic activities depend on the conditions of life, notably in regard to air, temperature, and substrate (quality of milk). While the saccharolytic function prefers high temperatures, the caseolytic manifests itself particularly at low temperatures between 15° and 20° C; it is also necessary to use milk not too thoroughly sterilized in the autoclave. In this manner one can demonstrate that even certain varieties of *Streptococcus lacticus* possess acidoproteolytic properties. To this should also be added the engenesic influence which the acidoproteolytic ferments exert upon the simple lactic ferments by rendering the casein available for them.

Besides the coccus forms, I have also found acidoproteolytic bacilli in ripening cheese, which I have described under the name of "*B. acidificans presamigenes casei.*" They are spore-bearing bacilli similar in form to *B. subtilis* or *B. mesentericus* or tyrothrix; but they can be differentiated by the fact that they acidify milk and always peptonize it in an acid reaction. These same types of bacilli, which can be called sporogenous lactic ferments, I have recognized in fodder, from which they apparently get into the milk. Lately they have been found by Sandelin and Barthel in cream, by Grimmer and Hucker, respectively, in Tilsit and Cheddar cheeses, and by Laxa in milk and soft cheese.

Finally, I have shown that the acidoproteolytic ferments, both cocci and bacilli, are susceptible to sharp and spontaneous mutations and retromutations by individual divergences, whereby they may for some time lose or acquire peptonizing properties.

In conclusion, the acidoproteolytic bacteria are able to explain the process of cheese ripening, for which there are not enough of either the simple lactic bacteria which do not attack casein in the acid medium, or the simple peptonizing bacteria which do not live at all in acid medium. In that manner my acidoproteolytic theory has put the problem on a more logical basis and has conciliated the lactic acid theory of Freudenreich with the tyrothrix theory of Duclaux, Adametz, and Weigmann.

Besides, according to my views, the milk of the animal already contains bacteria and bacterial enzymes (galactase?) necessary for the ripening of both hard and soft cheese.

LA DISCIPLINE DES PROCÈS FERMENTATIFS CHEZ LES FROMAGES ITALIENS. — 3/4

Costantino Gorini, Ph. D., directeur du laboratoire de bactériologie, à l'Ecole Supérieure d'Agriculture de Milan, Italie.

Je donne ici un court résumé des recherches et des expériences, que je poursuis depuis plus qu'une vingtaine d'années sur la fabrication rationnelle des fromages italiens, en disciplinant les procès fermentatifs par l'emploi de ferments sélectionnés accouplés avec la production et l'entretien hygiénique du lait afin de réduire au minimum le souillement du lait.

Que par l'emploi de cultures pures de ferments sélectionnés on arrive à influer favorablement sur la réussite des fromages, même dans les conditions ordinaires de la pratique courante, a été démontré premièrement par mes expériences à l'égard du fromage italien grana ou Parmesan (1906).

Les avantages que l'on peut en tirer sont de deux ordres: combattre les fermentations anticaséaires et améliorer les qualités intrinsèques de la pâte en en accélerant la maturation.

Mais dans le cours des applications des cultures pures sur des types différents de fromage que je dirige depuis une quinzaine d'années chez plusieurs industriels, j'ai démontré aussi que la réalisation industrielle de ces avantages est liée à différentes conditions qui ont trait à trois points: (1) Les qualités du lait; (2) la qualité des cultures pures; (3) les modalités de l'emploi de ces cultures.

1. *Qualités du lait.*—J'ai trouvé qu'un lait peut être rebelle à l'action disciplinante des ferments sélectionnés pour deux raisons: par sa microflore anticaséaire et par une déviation de ses aptitudes caséaires et fermentatives.

Quant à la microflore anticaséaire du lait on doit craindre bien plus la nature que le nombre de ses composants. Les plus dangereux sont les microbes gazogènes et parmi eux les ferments butyriques surtout, parce qu'ils sont les moins facilement disciplinables par les cultures pures. Ces ferments, comme je l'ai démontré, proviennent du lait, par voie directe ou indirecte (par le moyen des selles), notamment des fourrages mal conservés ou qui ont subi des fermentations butyriques et putridogènes; tels sont surtout les foins et les silos que j'ai appelé précisement "butyriques." Pour prévenir un tel danger j'ai étudié la préparation des foins et des silos que j'ai appelé "lactiques," et j'ai observé que l'on peut les obtenir en enfouant les fourrages à demi desséchés et en les sousmettant à une compression hâtive et énergique (10 quintaux par mètre carré) de manière à limiter la température de fermentation au dessous de 50° C.

Quant aux aptitudes caséaires et fermentatives, le lait peut se présenter sans variations visibles dans ses caractères organoleptiques et, toutefois, être impropre à la caséification à cause de modifications dans sa constitution chemio-enzymatique, dans son comportement à la présure et dans sa propriété inhibitoire ou germicide. Ces modifications, qui ne sont pas corrigibles par les cultures pures, sont la conséquence de troubles sécrétoires déterminés par une microflore mammaire anormale qui peut susciter des phénomènes de réaction cellulaire même sans manifestations inflammatoires de la mammelle. J'ai démontré que la développement de la microflore mammaire anormale est lié aux stagnations de lait dans la mammelle qui dépendent d'une traite incomplète ou maladroite; pourtant, pour éviter les susdites altérations dans les aptitudes caséaires et fermentatives du lait, il faut accomplir la traite dans une manière complète, propre, correcte et polie.

2. *Qualité des cultures pures.*—En principe il est conseillable d'employer un mélange des ferments lactiques simples indiqués par Freudenreich (qui n'attaquent guère la caséine en milieu acide) avec les ferments lactico-protéolytiques indiqués par moi (qui solubilisent la caséine même en milieu acide); cela indépendamment de leur forme coccique ou bacillaire, car ce qui importe est leur fonction.

Les ferments lactiques simples, étant doués d'un potentiel acidificateur plus élevé, servent spécialement pour combattre les fermentations anticaséaires, tandis que les ferments lactico-protéolytiques servent spécialement pour améliorer la pâte en accélérant la maturation; tous les deux cependant servent pour supprimer le défaut de l'amertume. Quant aux particularités de goût et d'arome qui caractérisent certains types de fromages, je ne peux pas encore dire rien d'absolu au sujet des espèces de ferments que l'on doit préférer; pour le moment il faut avouer qu'il s'agit d'avoir la main heureuse dans le choix, voilà tout.

3. *Modalités d'emploi des cultures pures.*—A ce sujet il faut avant tout que le lait, avant de descendre dans la chaudière, soit conservé à une température très basse, possiblement autour de 5° C., de sorte qu'il se maintient pauvre en microbes de toute espèce, aussi bien en germes anticaséaires qu'en germes caséophiles; il contiendra pourtant toujours une certaine quantité de ces ferments lactico-protéolytiques, qui existent normalement dans la microflore mammaire et contribuent à la maturation des fromages. Pour pourvoir à l'insuffisance éventuelle des autres types de bons ferments on se sert de l'inoculation des cultures sélectionnées.

Les cultures peuvent être préparées en bouillon lactosé ou bien en sérum ou en lait, pourvu qu'elles n'arrivent pas à des degrés d'acidité capables d'affaiblir les ferments mêmes. La dose de la semence peut osciller depuis un quart à un pour cent, suivant l'aptitude fermentative du lait, son degré de maturation, etc.

Pendant la travail du lait dans la chaudière il faut avoir soin, en premier lieu, d'employer de la présure pure non souillée par des germes anticaséaires; en second lieu, de procurer que le caillé s'accomplisse à une température et dans un laps de temps qui permettent une propagation suffisante des ferments caséaires avant d'initier la cuisson; en troisième lieu, de pousser la cuisson à des températures qui hâtent le développement des cultures inoculées, mais non pas au-delà. Il est aussi nécessaire de ne pas dépasser le degré d'acidité qui est compatible avec la vie des ferments employés. Même lorsque le fromage est sorti de la chaudière on doit le placer dans un endroit où son refroidissement s'accomplit graduellement afin que le développement progressif des ferments bénins ne soit pas interrompu brusquement avant le temps qui leur est nécessaire pour réprimer les ferments malins.

En somme, il faut toujours et dans chaque opération avoir sous les yeux de fabriquer le fromage comme s'il s'agissait d'apprêter une culture des microbes caséaires.

Conclusion.—Mes expériences ont démontré qu'il est possible de discipliner les procès fermentatifs chez les fromages italiens par l'emploi convénient de cultures sélectionnées de ferments lactiques (Freudenreich), et lactoprotéolytiques (Gorini), pourvu que cet emploi soit accouplé avec la production et l'entretien hygiénique du lait, visant surtout à exclure la contamination du lait par les ferments butyriques et les altérations des aptitudes caséaires et fermentatives du lait. A ces deux points de vue sont à redouter notamment (1) les fourrages conservés dans les silos butyriques qui doivent être substitués par des silos lactiques; (2) toutes les causes qui provoquent le développement d'une microflore mammaire anormale, et tout spécialement les stagnations de lait dans la mammelle qui sont évitables par une traite accomplie en manière complète et correcte.

[Abstract.]

CONTROL OF THE FERMENTATIVE PROCESSES IN ITALIAN CHEESE TYPES.

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The following is a short résumé of the research and experimental work conducted during the past 20 years on the rational manufacture of Italian cheese, by controlling the fermentative processes by the use of pure cultures, coupled with hygienic methods, in order to reduce the contamination of milk to the lowest possible minimum.

It was demonstrated, primarily by my experiments with respect to grana or Parmesan cheese (1906), that by the use of pure cultures of selected ferments we can obtain a favorable influence on the resulting cheese, even under ordinary conditions and current practices.

The advantages we can derive are of two kinds: Fighting against detrimental fermentations and improving the intrinsic qualities of the curd by hastening the ripening. But I have also shown that the industrial value of these improvements is connected with different conditions which are narrowed down to three points: (1) The quality of the milk; (2) the quality of pure cultures; (3) the methods of using these cultures.

(1) *Quality of the milk.*—I have found that a milk may be ill adapted to the use of pure cultures for two reasons: By its detrimental bacteria, and by a variation in its fermentative and cheesemaking adaptabilities. As to the detrimental bacteria, we should fear their nature much more than their number. The most dangerous are the gas-forming bacteria, particularly the butyric bacteria, because they are the most difficult to control by pure cultures. These bacteria, as I have shown, appear in the milk, especially by poorly preserved forages, such as hays and silages, which have undergone butyric and putrefactive fermentations. To prevent such danger, I have studied ways of preparing hays and silages which I have called *lactic*. I have observed that we can obtain this by ensiling the half-dried hays and subjecting them to an early and energetic pressure in such a manner that the temperature of the fermentation

will not exceed 50° C., and also, in several cases, by the inoculation with lactic acid bacteria.

As to the fermentative and cheese-making adaptabilities, milk may, without perceptible variations in its organoleptic characteristics, be unsuited for cheese making because of modifications in its chemicozymatic constitution, in its relation to rennet and its restraining or germicidal action. These modifications which can not be corrected by pure cultures are a result of secretory troubles induced by an abnormal mammary bacterial flora, which can create cellular reaction even without noticeable inflammation in the udder. To prevent the occurrence of such results by avoiding stagnation of milk in the udder, the milking must be done in a complete, proper, and correct manner.

(2) *Quality of pure cultures.*—It is advisable, in principle, to use a mixture of simple lactic bacteria, indicated by Freudenreich (which do not attack the casein in acid reaction), with my lacto-proteolytic ferments which render casein soluble even in acid medium. This is independent of their coccoid or bacillary form, for it is their function which counts.

(3) *Methods of using pure cultures.*—The milk, before being put into the vat, must be held at a very low temperature, possibly around 5° C., in order that the number of bacteria of all kinds, including both dangerous and favorable bacteria, be held as low as possible. It would always contain, nevertheless, a certain quantity of lactoproteolytic bacteria which I have shown exist normally in the mammary bacterial flora and contribute to the ripening of the cheese. The inoculation of selected cultures serves to make up for the lack of other types of ferments.

During the working it is always necessary in each operation to carefully watch the manufacture of the cheese as if it were a matter of preparing a culture of caseous microbes.

THE CONNECTION BETWEEN THE BACTERIAL CONTENT OF MILK FROM WHICH CHEESE IS MADE, AND THE RAPIDITY OF RIPENING OF THE CHEESE. — 321

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In two communications from this experiment station, one of us (Barthel) (1, 2), has shown that lactic acid bacteria belonging to the group *Streptococcus lactis* possess the power of decomposing paracasein to a marked degree, especially at a temperature of 14° to 20° C.; i. e., at the usual cheese-ripening temperature. The fact that earlier investigations of the casein-splitting powers of such lactic acid bacteria usually gave negative results, is explained by the much higher temperatures at which they were carried out, usually at 35° C., and never under 20° C. Prior to our investigations referred to above, it was generally supposed that the action of the common lactococci in cheese ripening was chiefly of an indirect nature, i. e., that by forming lactic acid they would cause the formation of the curd, help the proteolytic action of the rennet, and hinder the development of putrefactive bacteria.

The proof that the common lactic acid streptococci possess a marked power of splitting casein at temperatures coinciding with the usual storage temperatures for hard cheeses, made it highly probable that the activities of these bacteria in cheese ripening were not confined to producing the above mentioned indirect effects, but that they really played a direct part in the decomposition of the paracasein during the ripening of the cheese.

This view is also supported by the fact that in most hard cheeses it is just these lactic acid bacteria which are absolutely the dominating ones in the bacterial flora, at any rate during the first months of ripening, while the practical dairyman considers that he can influence to some degree the course of the ripening by adding to the cheese milk greater or smaller amounts of starter, i. e., sour or coagulated skim milk or buttermilk. From our investigations it appeared that different strains of bacteria belonging to the group in question showed quite important differences in their ability to decompose casein. This circumstance made practical cheesemaking trials highly desirable. By determining the rate of ripening, when lactic acid bacteria of different casein-splitting powers are added to the cheese milk, it should be possible to elucidate to some degree not only the general significance of these lactic acid bacteria in cheese ripening but also in what manner the proved difference in casein-splitting power of such strains comes to bear on the rate of ripening of the cheese.

This reasoning led us to carry out a number of preparatory cheesemaking trials, which will be briefly described here.

The milk for these trials was holder-Pasteurized at 63° C. for 30 minutes, then cooled on an ordinary milk cooler and transferred to the cheese vat. The milk was then brought to a convenient temperature for rennet coagulation (30° C.) and treated with lactic acid bacteria of known casein-splitting powers, after which it was at once coagulated with rennet. The lactic acid bacteria to be used in the trials were cultivated in sterilized skim milk. The same amount of culture, corresponding to 1.5 per cent of the amount of cheese milk, was used in all the trials, and three different strains of lactic acid bacteria, differing in their casein-splitting power, came into use in these cheesemakings. In all the trials whole-milk cheeses were made with gouda texture and salted in brine. After the cheeses had been kept for about three months the amounts of soluble nitrogen and amino nitrogen were determined (the latter by Van Slyke's method) and the nitrogen found was expressed in percentages of the total nitrogen of the cheese. As these trial cheese makings were of quite a preparatory nature, we considered that their number should be limited, and we therefore only carried out three cheese makings, one with each of the bacterial strains. These strains were characterized thus: No. 1 did not possess any appreciable power to decompose casein in milk treated with chalk, while No. 3 had a marked ability to do so. No. 2 was intermediate in this respect.

The results of these trials can be seen in Table 1.

TABLE 1.—*Comparison of three bacterial strains.*

Number of cheese makings.	Bacterial strain.	Time required.				In green cheese.		Time of storage.	In ripened cheese: Per cent of total nitrogen found as soluble and amino nitrogen.	
		Setting.	Heating.	Stirring.	Total time employed.	Fat in total solids.	Water in cheese not fat.		Soluble.	Amino.
		Minutes.	*Minutes.*	*Minutes.*	*Minutes.*	*Per cent.*	*Per cent.*	*Days.*	*Per cent.*	*Per cent.*
3	No. 1......	47	43	62	152	49.6	61.6	95	25.8	7.4
3	No. 2......	47	45	58	150	49.7	59.9	98	24.5	6.1
3	No. 3......	45	42	46	133	49.5	58.4	93	25.5	7.7

It will be seen in the table that the time required for making the cheese, i. e., the sum of the times for curdling, heating, and stirring afterwards, is obviously dependent on the bacterial strain which was added to the cheese milk; thus, No. 1 required the longest and No. 3 the shortest time; i. e., 152 and 133 minutes, respectively. That these differences could not be due to the fat content of the cheese milk is shown by the next column, in which the fat contents of the fresh cheeses are given, expressed in percentages of the total solids.

The water contents of the fresh cheeses, expressed in percentages on the cheese less fat, are also given in the table. These water figures show that when strain No. 1 was added to the cheese milk cheese with 61.6 per cent of water, calculated on the fat-free curd, was obtained in spite of the cheese being treated for 152 minutes in the vat; on the other hand, when No. 3 was used the water content of the cheese reached only 58.4 per cent, although the working time occupied only 133 minutes. Strain No. 2 takes an intermediate position in these respects.

The difference in working times given is, of course, the result of our endeavors to obtain cheeses with the same water content. When the cheese gave off whey slowly the working time was lengthened. In spite of this, the water content of the cheese treated in the vat for 155 minutes became the highest and that of the cheese treated for 133 minutes the lowest. The differences in the working times were thus not sufficient to counteract the differences in the tendencies of the cheeses to separate off their whey.

As this tendency to separate off the whey is very largely dependent on the rapidity with which lactic acid is formed inside the curd particles, it is easy to explain the differences in question as being due to the differences in character of the lactic acid bacteria added to the cheese milk.

In the last two columns of the table are given the amounts of soluble nitrogen and amino nitrogen, formed after keeping the cheese for about three months.

For all three cheese-making groups the percentages are practically the same. Thus, the investigations gave quite a negative result in this respect, no differences in effect due to the different casein-splitting powers of the lactic acid bacteria added being noticeable.

We did not, however, consider that we should give up making further experiments on the effect of different strains of lactic acid bacteria on the rapidity of cheese ripening. The technique employed in making the cheeses in the above trials was in several respects faulty, and, moreover, we were entirely without knowledge as to the real bacterial contents of the milk at the moment of curdling.

The technique of the cheese making should be perfected so that the water content should, if possible, be the same in all batches, and so that this water content should agree with that of similar cheese made under perfectly normal conditions. The bacterial content of the milk at the time of heating is influenced partly by the fresh infection which may take place after Pasteurizing and chiefly by the number of bacteria in the starter added to the cheese milk. The use of the same amounts of culture in all batches is no guaranty that the cheese milk will constantly contain the same number of bacteria, and only under the last-mentioned condition can the results be strictly comparable.

Since we had gained knowledge of the normal water content of cheese of the type which we aimed to produce in continued experiments (by exhaustive investigations, the description of which would carry us too far), we sought to form an opinion as to *how far the bacterial content of the cheese milk at the moment of adding rennet could have any effect on the rapidity of the cheese ripening.* The impression very common among practical dairymen that the addition of an increased amount of starter to the cheese milk shortens the time necessary for ripening the resulting cheese speaks in favor of the view that there is such an effect. That the bacterial content of the milk at the time of addition of rennet has the effect in question, in spite of the long time usually required for ripening the cheese, can be explained by the fact that the bacteria in milk live in a liquid while in the cheese they live in a solid medium. If the milk is rich in bacteria when curdling occurs, then the curd particles should contain an appreciably larger number of colonies of bacteria than when the milk is poor in bacteria when rennet is added. The solid nutrient medium to which the curd particles may be regarded as corresponding, thus becomes much more thickly strewn with bacterial colonies in the former case than in the latter. L. D. Bushnell's investigations (3) show that 95 to 98 per cent of the bacteria which the milk contains at the time of curdling are found again in the curd formed.

From a purely practical point of view, the conditions in question find expression in the different rapidities with which the acidity of the whey increases while the cheese is being treated in the vat. If an appreciable amount of the whey is removed before the heating and the subsequent stirring take place, the acidity of the whey increases particularly fast because the amount of curd is large in proportion to that of the whey left behind. If, on the other hand, the whole amount of the whey is kept in the vat while the cheese is being worked, then the acidity of the whey increases much more slowly. It is within the curd particles that most of the lactic acid formation takes place, a sign that these particles are much richer in bacteria than the surrounding whey. From G. J. Hucker's investigations (4) it even follows that the bacterial content of the milk when rennet is added really exercises a certain influence on the nature of the resulting cheese. Hucker worked with milk which showed varying bacterial contents on arrival in the dairy. He had no further knowledge as to the nature of the kind of bacteria occurring in the milk, and this is surely the reason why he obtained such widely differing results. From these experiments, however, it appeared that the milk which contained the largest number of bacteria yielded a uniform cheese of good quality, while on the other hand, a low bacterial content in the milk had the effect of producing cheeses varying considerably in quality.

Before taking up new investigations on the influence of different bacterial strains on the ripening of cheese it was therefore desirable to investigate how far the bacterial content of the milk at the time of curdling exerted any appreciable effect on the rapidity of the ripening of the cheese; for should this be the case, then in making the next trials it would be necessary to take into account not only the properties of the bacterial strains added to the cheese milk *but also the total bacterial content of the milk.* In order to throw some light on this question a number of preparatory investigations were made in which milk containing varying numbers of lactic acid bacteria was made into cheese under conditions as similar as possible. These trials were made as follows:

The milk used came directly by motor from a well-kept farm not far from Stockholm. For each trial 75 liters of milk were taken and separated cold, after which the fat percentage was adjusted to 1.5. Of this milk with 1.5 per cent of fat 70 liters were transferred to the cheese vat, Pasteurized there at 63° C. for 30 minutes, and cooled to the coagulating temperature. Then sufficient hydrochloric acid was added to bring the acidity of the milk back to the same degree as before Pasteurization (the Pasteurization generally caused a lowering of the acidity by about 0.5 degree Soxhlet-Henkel). Finally 1 per cent of starter, or pure culture, was added to the milk, which was then left to ripen at 28° to 30° C.

As an approximate measure of the increase in the bacterial content during ripening the rise in acidity was used. If the rennet was added immediately after the admixture of the starter the rise in acidity was indicated as 0.0 S.-H. An increase of the acidity by 0.5 or 1.0 thus means that the acidity had increased by 0.5 or 1.0 S.-H. above that shown by the milk when the 1 per cent of starter had been added.

The curdling temperature was 30° C. and the heating temperature 34° to 36° C.; the same water percentage was always aimed at; i. e., 59 to 60 per cent calculated as percentage on the fat-free cheese. Rennet powder was used for curdling.

The bacterial counts were made microscopically on the addition of the starter and after the milk had ripened to the desired acidity.

The cheeses were stored under normal conditions for two months, after which samples for analysis were taken each month, while the cheeses were examined for texture and taste at the same time. The chemical analysis included the determination of total nitrogen, soluble nitrogen, amino nitrogen, fat content in solids, and water percentage calculated on the fat-free cheese. Table 2 gives a summary of the results obtained in these trials. Here the total nitrogen and the amino nitrogen are not included.

TABLE 2.—*Results of trials with different bacterial strains.*

Lot No.	Designation of bacterial strain.	Degree of ripeness of the cheese milk.		Portion of total nitrogen in the cheese, found as soluble nitrogen.	
		Increase in acidity.	Bacterial content.	After 30 days.	After 60 days.
			Millions per c. c.	*Per cent.*	*Per cent.*
1a	M	0.0	66.3	14.3	25.0
1b	M	.5	83.9	21.9	28.3
1c	M	1.0	164.8	26.8	34.3
2a	M	.0	61.1	19.1	26.7
2b	M	.5	167.0	27.5	31.6
2c	M	1.0	251.8	27.5	33.8
3a	R I	.0	51.6	19.7	26.1
3b	R I	.5	53.4	19.0	....
3c	R I	1.0	122.4	23.4	28.0
4a	R I	.0	....	17.7	25.2
4b	R I	.5	212.1	24.0	28.6
4c	R I	1.0	293.9	26.0	30.2
5a	R II	.0	28.5	19.0	29.5
5b	R II	.5	42.3	25.4	32.1
5c	R II	1.0	88.3	30.0	36.2
6a	R II	.0	36.6	21.4	25.9
6b	R II	.5	108.3	22.7	27.8
6c	R II	1.0	242.3	28.2	31.7

A priori one could hardly expect any exact parallelism between the bacterial content of the cheese milk on the one hand, and the rapidity of ripening as expressed by the amount of soluble nitrogen at certain intervals, on the other, but the figures given in Table 2 nevertheless show as clearly as could be desired that unmistakable connection does exist between these two factors.

We find from the table that an increase in the acidity of the milk which took place when the milk was allowed to stand and ripen (being thus due to an increase in the bacterial content) always caused an increase in the amount of soluble nitrogen formed within a certain time; this must presumably be regarded as the chemical expression for a shorter ripening time. By special trials, which are not yet finished, we have found that the acidity itself, which of course, rises with the content of bacteria in the cheese milk, has no effect on th shortening of the ripening time, but that this shortening must really be attributed to the increase in bacterial cells.

If now on the basis of these results it can be upheld as probable that the rapidity of the ripening of the cheese during the first stages is more or less directly dependent on the bacterial content of the cheese milk (and by bacterial content we mean the content of lactic acid bacteria) then it can also be understood how the foregoing trials with bacterial strains of relatively different casein-splitting powers (Table 1) could give an absolutely negative result. This naturally depended on the fact that in these experiments no account was taken of the total bacterial content of the cheese milk at the time of curdling. It is clear that in order that a bacterial strain possessing a greater power of splitting casein should induce a correspondingly more rapid ripening, the bacterial content of the cheese milk should be of the same magnitude as in the milk to which a less powerful casein splitter was added. Otherwise the superior splitting power might conceivably be counteracted by a lower bacterial content.

The manner in which the cheese milk is soured may also possibly have some effect on the rapidity of ripening, for in an ordinary starter a large proportion of the lactic acid bacteria are certainly so firmly embedded in the coagulum that when the culture is mixed with the cheese milk they do not come into direct contact with the milk, and therefore not with the newly precipitated paracasein. Thus these bacteria could not be considered as having any real influence on the cheese-ripening process. If, however, the cheese milk is allowed to ripen, then the bacteria in it will be free and loose, and when the coagulation takes place, each bacterial cell will from the outset be in direct contact with the paracasein, and can form a colony. Moreover, in a starter which is coagulated when used, quite a number of cells will undoubtedly be already dead, but in a ripening milk it can safely be assumed that the number of dead cells will be quite negligible.

We are now occupied with more exhaustive investigations of questions such as these, which will be published in due course. In the meantime, we considered that it might be of interest to set out at this stage the most important of the results obtained in the trials made up to the present by us.

SUMMARY.

One of us (Barthel) previously showed that the ordinary lactic acid bacteria belonging to the *Streptococcus lactis* group could decompose casein at temperatures usually employed in storing cheese (14° to 20° C.) and that, therefore, a far more important part must be ascribed to the action of these bacteria in the ripening process of hard cheeses than has hitherto been done. Moreover, these lactic acid bacteria are, during the first few months of ripening at any rate, absolutely predominant in the bacterial flora of the cheeses in question.

Attempts to influence the rapidity of the ripening of the cheese by the addition to the cheese milk of starters consisting of cultures of lactic acid streptococci having different powers of splitting casein were not successful. A probable explanation of this result lies in the circumstance that in these trials, although equal quantities of starter were added of the different strains, yet we had no knowledge of the actual total number of bacteria added. It certainly seems probable that the rapidity of the ripening of the cheese is directly dependent on the number of bacteria in the cheese milk at the moment of adding rennet. In order that the above trials with different bacteria should be really comparable with one another, it was, of course, necessary that the number of bacteria in the cheese milk at the moment of adding rennet should be the same in all cases.

In the first place, it was necessary to find out how a definite connection could be demonstrated between the total number of bacteria in the cheese milk on coagulation, on the one hand, and the rapidity of ripening of the cheese on the other. We also made such investigations, and showed that a connection of this kind undoubtedly exists. By bacterial content we naturally mean the content of lactic-acid bacteria. The rapidity of ripening of the cheese was determined in these trials by means of determinations of soluble nitrogen expressed in percentages of the total nitrogen, carried out on samples taken at definite intervals.

That the rapidity of the ripening of cheese thus appears to be fairly directly dependent on the number of bacteria in the cheese milk is confirmed by practical experience, according to which it is considered possible to influence the course of ripening by adding starters to the cheese milk or by letting the milk ripen to a certain degree of acidity. In both of these operations, of course, a large number of lactic acid streptococci are added. As we found the above-mentioned connection to exist, we proposed to return to the investigation of the question as to how far it is possible by the addition of strains of lactic acid bacteria of different casein-splitting powers to the cheese milk (pasteurized to 63° C. for 30 minutes) to influence the rapidity of the ripening of the resulting cheese.

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THE USE OF SELECTED LACTIC FERMENTS IN THE MANUFACTURE OF HARD-PRESSED CHEESE. — 22

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In order to secure desirable flavor and texture in cheese the cheese maker resorts to the use of a starter. A starter is simply a milk culture of certain lactic acid bacteria which grow quickly in milk and which produce a good-flavored dairy product. The starters in common use at the present time are more or less pure cultures of *Streptococcus lacticus* of which there are two distinct though closely related species: (1) *Str. lacticus* (diplococcus form) and (2) *Str. lacticus* (streptococcus form). The biological characteristics of these forms are so well known that they do not call for a detailed description in this paper. The first organism—the *Streptococcus lactis* of Jensen's recent classification—is common to cow's milk in North Britain and predominates in naturally soured milk. As a pure-culture starter this organism gives a nice, mild-flavored butter. It produces cheese of a fine soft texture but the flavor is inclined to become sharp after the third month of curing. It might be used with advantage in the manufacture of quick-ripening cheese like the English Derby. Its employment in cheese making must be limited because it is not very resistant and in practice is apt to become impure after a fortnight's use.

Strains used by us in our experimental work did not produce in pure culture the sour smell and unpleasant flavor noted by Jensen. The other form of *Streptococcus lacticus*, named by Jensen *Streptococcus cremoris* occurs typically in characteristic chains, and is the starter organism extensively used in British dairying. Hansen's lactic ferment contains this bacterium. When used as a starter this organism gives satisfactory results. It grows well between 15° and 25° C., is a fairly rapid acid producer, remains vigorous and pure for a considerable period, and is easily propagated. (But it tolerates *B. subtilis* and many members of the coliform group.) When clean milk is used it gives a good-flavored cheese; the cheese keeps well for four or five months, after which time the flavor is inclined to become sharp. This organism has distinct caseolytic properties and the ripening of cheese in North Britain is in large measure due to its activity.

In the laboratory, it is possible to keep these organisms alive for a lengthened time in solid media of a suitable nature, but the sugar content should be low, and the medium well buffered. A good liquid medium is a 4 per cent solution of milk sugar in water, the reaction of which is adjusted by lactic acid to pH 3.0. Such a medium will preserve the lactic acid bacteria for a lengthened time without the necessity of transference, but the culture should be held in light-protected bottles. In such a medium, one finds that the typical *Str. cremoris* temporarily loses its chaining habits and becomes a diplo form.

These ordinary lactic acid bacteria occasionally exhibit acquired characteristics. Some forms will produce a burnt flavor in milk, in butter, and in cheese. This peculiar property, which we have encountered on several occasions in starters, is only a temporary acquisition, and usually disappears when the organism is repeatedly subinoculated. In such a condition, the organisms are rapid acid producers, and the fermented milk has a sharp taste. We have found by experiment that Cheddar cheese made with such material acidifies rapidly during the making process, and exhibits a short texture when cured. Again many pure cultures will become slimy in milk. We have had repeated experience of this, but what has not been clearly recorded is that a slimy milk culture may exhibit a moderately high degree of acidity. Thus we have frequently found an acidity of 0.8 per cent lactic acid in a slimy milk culture of *Str. cremoris*. This sliminess is stated by some investigators to be a juvenile characteristic; it may sometimes be induced by repeatedly growing the subcultures at low temperatures; occasionally it is caused by the biological condition of the milk.

It should be observed that the value of a starter in dairying can not be correctly estimated by the morphological character of the typical organism, or by the common biological tests of the laboratory. It becomes increasingly clear that strain counts for more than anything else. Organisms that have apparently the same differentiating bacteriological features may have quite different values as starters. The value of strain has been clearly proved in the case of Conn's bacillus 41 in American dairying. In our own work, a strain of *Str. cremoris* isolated from a sample of goat's milk gave an unusually fine flavor to butter and cheese. The ability of a starter to remain pure under ordinary dairy conditions is also a most important feature; this is largely a matter of strain also. Some strains of the ordinary lactic acid bacteria possess this property in a high degree.

In marked contrast to the *Streptococcus lacticus* type are the lactic acid organisms of the *B. bulgaricus* type. Representatives of this group which we have made the basis of experiments are *B. bulgaricus* Massol, *B. freudenreich*, *B. bulgare* (from Pasteur Institute), *Bastonicini lactici coagulanti* Gorini, *B. bulgaricus* Samarani, *Streptothrix dadhi* Chatterjee, *Streptobacterium casei*, 11 and 32 (Jensen), *Bacillus acidophilus* Browning, bacillus of Tarkhana, and the bacillus of Laban Ra-yeb. These organisms, which are all closely allied, are distinguished by their morphology, by their staining properties, by the characteristic form of their colonies, by the kind and amount of lactic acid they produce, and by their strong caseolytic power. As a group, these organisms belong to the lactobacilli of Löhnis, or in the more recent classification of Jensen, to the thermobacteria and the streptobacteria.

The first representative of this group to which we directed attention in our technical work on cheese was the *B. bulgaricus* of Massol. Its main distinguishing characteristics are as follows: It is a gram-positive streptobacillus varying from 3.5µ to 10µ in sterilized milk, but often reaching from 30µ to 50µ in raw or Pasteurized milk. It makes little growth at temperatures below 37° C.; it grows rapidly at 40° C. It does not succeed on ordinary media, but on special whey agar made with casein peptone and additioned with autolyzed yeast extract it produces very characteristic colonies which are minute in size (one-half millimeter after 48 hours' growth) and in appearance resemble a mass of tangled hairs. The pH of the medium should range from 5 to 6. With methylene blue the organism shows differential staining, some parts of the protoplasm becoming more deeply impregnated than others. In *B. bulgaricus* these volutin-staining bodies are in successive rectangular blocks rather than in round beads. *B. bulgaricus* is nonspore bearing, but it is possessed of great vigor in milk cultures, and can be held over for much longer periods than *Str. lacticus* without the necessity for reinoculation. It has a rapid caseolytic effect at 37° C., which is slower but still quite distinct at 20° C. *B. bulgaricus* is not adapted for butter making, as it imparts a distinct cheesy flavor to the product, but when employed in the manner about to be described it produces a superb quality of cheese.

In our first experiments with *B. bulgaricus* Massol as a starter, we followed the usual technique in Cheddar cheese making, and employed the temperatures and acidities common to the Dunlop method. (The Dunlop cheese, which is of Scottish origin, is a white, soft-textured, meaty cheese, made after the Cheddar principle, but wrought at lower critical temperatures and acidities.) While cheese of a good quality and a special flavor emerged, the process of manufacture was unduly long, and a small proportion of ordinary starter had to be added to the cheese milk to induce a normally working curd. It was soon made apparent that temperature was a controlling factor, and in a subsequent batch of cheese the making temperatures were radically altered; e. g., ripening temperature of the cheese milk 102° F. (instead of 80° to 84° F.), renneting temperature 90° F. (instead of 84° F.), maximum temperature of scald 102° F. (instead of 96° F.).

This modification considerably shortened the time required to make a bulgaricus cheese, but it was still too long by a couple of hours. After running the whey, the acidity came on slowly, especially if the temperature was allowed to fall much below 100° F. To counteract this fall in temperature, the curd after the running of the whey was allowed to mat on the warm bottom of the vat, and water at 160° F. was added at intervals to the jacket of the vat. The curd thus kept warm becomes well matted on its lower surface, and is then turned over, and similarly matted on its other surface. When this stage is reached the curd is piled in blocks two deep on racks in the bottom of the vat and weighted. Hot water is run in below the racks and the vat covered over. In this way the temperature during cheddaring can be maintained at a little over 100° F.; curd so treated develops acidity at the usual rate.

Cheese made after this method acquires a rich and characteristic flavor which is quite distinct from the ordinary Cheddar flavor; it is more attractive, especially toward the end of the ripening period. The texture, however, is firmer than the Dunlop type and still firmer than the standard Cheddar texture. The cheese at pressing seemed to have the desirable body, but during curing the texture became unexpectedly tight. The evidence of 50 cheeses made after this manner confirmed this finding. Attempts were made to secure a softer type of cheese by following the principles practiced in the making of English Cheddars, which are noted for their soft smooth body. More moisture was retained in the curd consequent on an earlier renneting; and a lower acidity, on running the whey. The curd was allowed to develop a full acidity before milling. High ripening and cheddaring temperatures were employed as before. The resultant cheese had a full and fine flavor, but the texture was decidedly faulty, being short and inclined to brittleness.

A combination of *B. bulgaricus* and *Str. lacticus* used as a combined starter gave good results when ordinary temperatures were used, but there was a tendency to overacidity whenever the proportion of *Str. lacticus* was high. Experiments showed that not more than one-eighth per cent of the latter should be employed along with *B. bulgaricus.* But with such a combination of starters, it is somewhat difficult to secure uniformity in the finished article, especially with reference to texture.

It ultimately became evident that the degree of acidification of the curd is the factor which exercises the greatest control over the texture of the cured cheese, and that if a normal Cheddar texture is to be got, *B. bulgaricus* cheese must be made with acidities much lower than normal. It was therefore decided to make cheese after the method of the English Derby, but to employ temperatures to suit the organism. (The Derby is a popular English cheese which commands a ready market; it is one of the softest of the hand-pressed cheeses, ripens quickly, has a soft buttery texture and a mild but distinctive flavor.) When this course was followed, and the degree and rate of acidification of the Derby attained, a type of cheese with Cheddar characteristics was produced which exhibited a first-class flavor and texture. The texture, hitherto the weakest feature of a *B. bulgaricus* cheese, was now no longer faulty. At the age of four to five months, it was equal in texture to the best Cheddar, and the meatiness previously sought for was at length obtained. The flavor was full and distinctive, and without exception was appreciated by all cheese judges.

As the management of this type of cheese differs in some essentials from the Cheddar and the Derby cheeses, and is adapted to all starters of a similar type, a few observations on the process of manufacture will be given.

SPECIAL PROCESS OF MANUFACTURE.

In order to control the fermentation in the cheese milk overnight, a small quantity, usually a few drops, of starter is added to the evening's milk, which is stirred and cooled to 70° F. In the morning, an acidimeter reading is taken; starter at the rate of 1 per cent is added, and the morning milk is run in. The temperature of the mixed milk is adjusted to 100° to 104° F., kept at this for three-fourths hour, and then cooled back to 86° F., the temperature at which the rennet is added. If the cheese milk were renneted at 100° F., the resultant cheese would be too firm in texture, as our experiments have amply demonstrated.

Coagulation with normal rennet extract, added at the rate of 1 ounce to 20 gallons, is complete in 40 minutes. The curd is cut as for Cheddar, and an acidimeter reading of the whey taken immediately after cutting. This reading, which is usually about 0.13 per cent, gives an important clue to the development of acidity and the rate at which the subsequent scald should be conducted. After the curd has been hand stirred for 10 minutes, the temperature is raised 1° in every 3 minutes to a maximum of 96° to 100° F. (according to season and class of milk). The curd is pitched when sufficiently firm at an acidity of 0.15 to 0.16 per cent. In 30 to 40 minutes, the whey is run at an acidity of 0.18 to 0.20 per cent. It is important that the acidity should develop gradually, and that the whey should not be more acid than 0.20 per cent when it is run. (British Cheddars are usually dipped at 0.23 per cent.)

On the removal of the whey, a channel is cut down the center of the quickly matting curd, which after 20 minutes is cut up into 10-inch blocks. These blocks are piled two deep on the top of racks placed in the vat and weighted. The blocks are turned and piled until the curd is well cheddared and the requisite degree of acidity has been developed. If the temperature of the curd falls too low, so that acid formation is arrested or proceeds unduly slowly, the curd may be warmed by first placing it on the bottom of the vat, to the jacket of which hot water has been added, and subsequently on racks below which hot water has been introduced. We have usually found this procedure more necessary in the early and again in the later part of the cheese-making season.

After the third turning, the curd is cut into strips and placed on the cooler to reduce the temperature to that of milling. If this is not done, the curd at milling will be too soft, which factor, coupled with the high temperature of the curd, will result in a large loss of fat in the form of a white whey at milling and from the press. The curd should be milled when hot-iron threads three-fourths to one inch are got, and when the acidity is from 0.4 to 0.45 per cent. Salt is added to the cooled curd at a temperature of 76° F. and at the rate of 1 ounce to 3 pounds. The acidity of the press whey should be from 0.5 to 0.6 per cent. An acidity of over 0.65 per cent is generally too high if a soft meaty texture is desired.

Recently we have obtained excellent results by adding all the starter to the evening's milk. The quantity of starter required in the case of *Str. lacticus* when this procedure is adopted is 1 ounce to 40 gallons of milk, but much larger quantities are required when organisms of the *B. bulgaricus* type are used—up to 1 per cent of the volume of the evening's milk. When all the starter is added in the evening, the acidity of the evening's milk in the morning should not be higher than 0.25 per cent if the normal period of three-fourths hour at the maximum ripening temperature of 100° F. is to be allowed. If an acidity in the vicinity of 0.3 per cent in the evening's milk is recorded, the temperature of the milk after the addition of the morning's milk should be adjusted to 84° F., a short ripening period of half an hour allowed, and the routine described followed.

After several years of careful experimentation we are satisfied that the foregoing process of manufacture, if carefully followed, will produce with *B. bulgaricus* a cheese of excellent texture and an unusually fine flavor, which in an unrestricted market will command a higher price than ordinary Cheddar. The temperatures and acidities should be strictly adhered to, and the starter carefully prepared. The cheese is always true to type, and its manufacture can be confidently recommended to the skilled cheese maker. Its production in factories from milk pasteurized to 140° F. by the holding method is specially indicated. The important points in the making of this type of cheese are the use of pure high-grade milk, a regulated development of acidity during the making process, and a comparatively low acidity from the press. It should take the same time to develop 0.5 per cent acidity with *B. bulgaricus* cheese as it takes to develop 0.9 per cent acidity with ordinary Cheddar.

As regards the curing of these cheeses, certain distinctive features have to be recorded. The rate of ripening is somewhat slower than normal and the progressive changes in texture more marked. At the end of four weeks, the flavor has only faintly developed: the curd is still harsh and raw, and the texture consequently disappointing. At two months the characteristic flavor begins to appear and the texture to improve. At four months the fine distinctive flavor is appreciated. The texture is now soft and silky and mellow to the palate. The temperature of curing should lie between 50° and 60° F.

The same procedure was followed with other organisms of this group with uniformly successful results. Two of the most useful representatives are *B. freudenreich* and *Streptothrix dadhi. B. freudenreich*, whilst not so vigorous as *B. bulgaricus* Massol, is safer to use with milks which are easy to ferment. It produces cheese with a mild but very pleasing flavor and a silky texture.

which remains soft, even with advanced curing. A ripe cheese when cut across usually exhibits small irregular or ragged holes.

Streptothrix dadhi (the designation streptothrix is not morphologically correct) was found on the whole to be the most satisfactory of all the organisms experimented with. A pure culture of this bacterium, which is native to the sour milk of central India, was obtained from Doctor Chatterjee, of Calcutta University, by whom it was first described in 1910. As a starter, it proved to be reliable, was relatively easy to maintain in pure culture, and remained vigorous for a considerable time. It gives cheese of a soft meaty texture and of an excellent flavor. It seldom produces cheese with a firm or tight texture.

Three organisms, *Bastonicini lactici coagulanti* Gorini and streptobacterium 11 and 32 (Jensen), did not prove quite so vigorous as the aforementioned organisms; nevertheless, cheeses made with their aid were very attractive to the consumer, and earned very favorable commendation. The bacillus of Tarkhana appears to be closely related to *B. bulgaricus* of Massol, and produces cheese with similar characteristics.

As regards the quantity of starter to be employed in the case of individual organisms of this group, and also with reference to the acidity to be developed during the making process, some guidance may be got from the rate of acid production in the starter itself. When a starter develops 2 per cent acid or over in 12 to 16 hours, a low acidity from the press should be aimed at, 0.5 to 0.55 per cent being sufficiently high. Organisms producing 1.5 per cent acid in the same time may be allowed a higher maximum acidity from the press, and up to 0.65 or 0.7 per cent should be developed. The higher the rate of acid formation in the starter, the less need be added to the cheese milk.

CONTENU MICROBIQUE DANS LE FROMAGE GRANA PENDANT SA MATURATION.

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C'est l'usage que dans la fabrication du fromage italien grana, et particulièrement dans l'espèce qui s'appelle "Reggiano," on verse dans le lait différentes quantités de microbes, moyennant des ferments sélectionés, ou bien encore, comme on fait aujourd'hui, sous forme de ferments naturels en se servant dans ce cas du petit-lait fermenté.

Le petit-lait examiné immédiatement après la fabrication du fromage présente des quantités de germes très variables qui sont en relation directe avec le contenu microbique du lait et avec celui du ferment ajouté.

Pour rendre le petit-lait frais adapté à l'inoculation il est nécessaire de l'enrichir de microbes, soit moyennant l'addition de ferments sélectionnés, soit en le soumettant à la fermentation, c'est-à-dire en le rendant dans les conditions les plus favorables qui permettent un développement majeur des microbes utiles au désavantage des germes mauvais.

Les températures plutôt élevées au premier temps de la fermentation, sont particulièrement celles qui donnent dans le petit-lait le développement des bactéries lactiques, lesquels cependant même, plus en avant, continuent sans en être dérangés à se multiplier jusqu'à fermentation achevée.

Ces conditions favorables servent aussi, malgré en mesure beaucoup plus limitée, pour les streptococcus qui, au moment de l'examen du petit-lait dans l'inoculation du lait, se trouvent toujours en grand nombre.

Les températures élevées qui aident le développement des bâtonnets lactiques exercent par réflexion—si elles sont conservées pendant longtemps—une influence remarquable, même sur la qualité du fromage.

D'après de nombreuses expériences faites, portant le petit-lait moyennant un chauffage avec un poële exprès à 42–45° C. pendant 20 à 22 heures, j'ai toujours obtenu des fromages qui, dans leur propriété, s'éloignaient assez de la grana et se rapprochaient, au contraire, soit par les trous, soit par la saveur à l'Emmental.

Le fromage sitôt fait présente une flore bactérique identique à celle de son petit-lait.

D'après de nombreuses analyses faites sur du fromage frais, j'ai toujours pu constater les streptococcus lactiques en grand nombre, même pendant la saison froide, où d'habitude, en comparaison avec l'été, le quantitatif microbique paraît assez réduit.

Les lacto-bacilles se trouvèrent chaque fois signalés (cependant presque toujours en nombre inférieur à celui des coccus), soit ceux avec propriété de coagulation facile du lait, type *B. casei alfa* et *epsilon* de Freudenreich, soit ceux avec lente ou sans coagulation et avec propriété gazogène; et leur présence se rencontre continuellement en grande quantité pendant l'été, tandis qu'en hiver on n'en trouve d'ordinaire un petit nombre.

Dans cette dernière saison on a pu souvent remarquer les bâtonnets lactiques producteurs de gaz en majeure quantité de ceux avec facile coagulation de lait.

Entre autres microbes importants, outre les bactéries cités, nous trouvons les bactéries acido-présamigènes, saccaromycètes, et torules souvent présents en quantité considérable.

Le quantitatif des germes, déjà très élevé dans le fromage de préparation récente, augmente encore remarquablement pendant la maturation, particulièrement pendant les premiers temps, jusqu'à ce que la température dans la masse caséeuse reste élevée, rejoignant parfois des chiffres très élevés de microbes pour un gramme de fromage.

Arrivés au point maximum de l'augmentation le numéro des microbes commence à diminuer.

En suivant le procédé des bactéries lactiques, qui, à fermentation avancée du fromage sont toujours les majeurement représentés, nous observons que la diminution se prolonge pour longtemps, se faisant rémarquer spécialement dans les coccus, lesquels généralement disparaissent avant les formes bacillaires, malgré qu'en certains cas on peut apercevoir en quantité remarquable ensemble aux bâtonnets jusqu'à une époque très avancée de la maturation.

En ce qui concerne les ferments nuisibles aux fromages, il faut rappeler en premier lieu les bactéries du groupe coli-aérogènes presque toujours contenu dans le lait, mais leur action dans le fromage parmesan (grana) est d'habitude très réduite, soit à cause de la température élevée de la cuisson, soit par l'antagonisme des ferments lactiques, si bien que, généralement, on ne doit à ce microorganisme un grand pourcentage d'écart.

L'on peut dire de même des ferments butyriques et des autres anaérobes sporogènes, qu'excepté des cas exceptionnels dûs au mauvais lait ou à une irrationnelle fabrication, j'ai toujours pu constater ou manquants ou présents, mais seulement en très petites quantités dans le fromage grana.

Très fréquemment se sont démontrées certaines fermentations tardives qui causent dans le fromage des trous irréguliers plus ou moins accentués, accompagnés parfois de feuilletage (sfogliatura ou fessurazione) sans cependant causer de variations notables à la saveur et à l'odeur du fromage.

En concluant, la flore microbique normale du fromage grana ne se distingue pas beaucoup de celle des autres fromages à pâte cuite et comme dans ceux-ci, aussi dans le grana, les bactéries qui prédominent et que pour plus longtemps maintiennent dans le fromage leur règne, sont les ferments lactiques et spécialement certaines brèves formes de bâtonnets; quelques-unes avec rapidité, d'autres avec une lente ou aucune coagulation du lait, avec légère ou sans production de gaz; et diverses coccus lesquels développent aussi une action favorable particulièrement en accélérant la maturation du fromage.

[Abstract.]

BACTERIAL CONTENT OF GRANA CHEESE WHILE RIPENING.

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The normal bacteria of grana cheese do not differ very much from those of other cooked curd cheeses, and, as in the latter, the bacteria, which prevail and last longer in cheese are the lactic type, especially certain of the rod forms, some of which cause immediate coagulation of milk, and others slow coagulation or none at all, with only a very slight or no production of gas. Also, there are several cocci which develop a favorable action as they help to hasten the ripening of the cheese.

Concerning certain ferments injurious to cheese, the first ones to be mentioned are the bacteria of the coli-aerogenes group. Their action in grana, however, is greatly reduced, either by the high temperature of cooking or by the counteraction of lactic ferments, so that generally not a large percentage of waste should be attributed to these bacteria. The same may be said of butyric ferments and of other sporeforming anaerobes which, with the exception of rare cases due to bad milk or irrational treatment, are always absent, or, if present, they occur in very small quantities. Much more frequent are some belated fermentations which produce in the cheese very irregular eyes, which are more or less marked and frequently accompanied by crumbling. These, however, do not cause noticeable changes in the taste or odor of the cheese.

THE RIPENING OF CHEESE.

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It was formerly assumed that milk in the udder is sterile, on the ground of Pasteur's contention that all the juices of the body are sterile, and of Lister's researches. It has, however, been found that this view is not right. It is true that the milk is secreted in a sterile condition by the alveoli, but already in the spongy tissue, the milk ducts and the milk bosom, infection takes place with bacteria which are believed to find their way into the milk through the constrictor of the teat and to multiply in the milk so far as it is a favorable medium for them. At the moment the milk leaves the udder in milking it is in some measure infected, but this infection is slight in comparison with that which takes place in obtaining the milk in the way this is done on the modern farm. Bacteria from the skin of the cow, from the hands and the clothes of the milker, from the air, from feces that have got on the udder, from the milking utensils, and so on, cause the bacterial content to reach a very high figure. The bacteria which infect the milk that has just been drawn consist largely of different species of diplococci or monococci, some of which form colored colonies and several of which liquefy gelatin. If a number of these cocci are introduced into sterilized milk it is gradually curdled, a slight acidification taking place and pepton being formed. The fact that these species of bacteria curdle the milk at a low degree of acidity gives rise to the question whether they do not also secrete a rennet-like enzyme, since the increase of the acidity is not such as to be sufficient in itself to cause the curdling. That acid and rennet are formed by some bacteria is well-known; some investigators have observed this in the case of several bacteria.

In addition to these species of cocci, the freshly drawn milk is infected by lactic acid ferments, by which are understood those bacteria which form lactic acid out of milk sugar in such a way that few other decomposition products are formed. They ought therefore to be carefully distinguished from those species of bacteria which when introduced into milk produce, among other things, some lactic acid. There are many such bacteria.

The infection of milk with lactic acid ferments, however, does not take place in such a degree as might be expected from the very general occurrence of these bacteria. Yet these bacteria, which are able to change not only lactose but also glucose, galactose, levulose, maltose, etc., find an excellent nutritive medium in the milk so that they soon outnumber the others.

Conn and Esten found that in milk received in sterile bottles, straight from the cow, there was, after six hours, an increase of the lactic acid ferments, and that after so short a time there were considerable numbers of the *Bacterium acidi lactici*. After 24 hours, their number often amounted to 90 per cent of all the bacteria in the milk, and sometimes more, two other species of lactic acid ferments having appeared besides. After 60 hours practically the only species left were three kinds of lactic acid bacteria, the other bacteria having died.

Now, if cheese is made from ordinary farm milk, the bacteria are for the greater part held fast by the curdled mass, part of them, about 20 per cent, being left in the whey, but most of them being inclosed in the curd. According as circumstances in regard to food, presence of oxygen, etc., are favorable to them or not, some species of bacteria will form colonies in the curd and others will not. Now the lactic acid bacteria are among those for which the curd is an excellent nutritive medium, and this is no wonder. A fresh cheese contains roughly 50 per cent of water, or 53.5 per cent of whey, if we reckon the solids not fat of the whey at 6.5 per cent; cheese, therefore, offers food in plenty to these ferments, in the form of milk sugar and proteins, to enable them to increase. As a result of this an intense lactic acid fermentation takes place in a cheese when it is under the press, in consequence of which, as in the case of milk, a large number of other species of bacteria die out. As their life is very short these latter species can hardly be said to have any vital influence.

The way in which the lactic acid ferments exercise their destructive influence on the other species of bacteria is not, however, the same in cheese as in milk. In milk the lactic acid bacteria, under ordinary circumstances, supplant the others by the action of the acid they secrete. In cheese other factors come into play. When a liquid containing the nutritive matter necessary for bacteria is inoculated with such microorganisms, these, if the other conditions required for their sustenance are not wanting, will naturally multiply. Their multiplication will not continue indefinitely, however, but will end either through the exhaustion of the medium, if too little nutritive matter is contained in it, or, in the opposite case, through the excretions of the bacteria themselves.

An instance of this is offered by sterile milk when inoculated with lactic acid ferments. In this case a lactic fermentation sets in, which converts the milk sugar into lactic acid. The lactic acid that is formed is unfavorable to the further growth of bacteria and puts a stop to it, in many cases when some 0.5 per cent has been formed. If the lactic acid is neutralized by an easily decomposable base of some metal which is not injurius to the microorganisms, a lactic acid salt is formed and multiplication will start again. Now milk contains different substances which are able in this way to combine with lactic acid, viz., calcium caseinate, calcium phosphate, and casein.

The influence, however, which these neutralizers have on the lactic fermentation, or, in other words, on the quantity of milk sugar which is converted into lactic acid in the milk, can never be very strong, because the quantity of lactose in milk is about 40 to 48 times as great as that of the CaO that it contains in an insoluble condition. In the milk of Dutch cows the amount of insoluble CaO was found to be 0.1266, 0.1156, and 0.108 grams per 100 cubic centimeters, whereas the lactose amounted to 5 grams. Assuming, for the sake of simplicity, that all the calcium combines with lactic acid, which is not the case, these quantities can, according to the equations,

$$C_{12}H_{22}O_{11}+H_2O=4C_3H_6O_3 \text{ and}$$
$$CaO+2C_3H_6O_3=H_2O+(C_3H_5O_3)_2Ca,$$

neutralize only the lactic acid formed out of

$$\frac{0.1266}{0.055}\times 0.171=0.3886,\ 0.353,\ \text{and}\ 0.330\ \text{grams}$$

of milk sugar, respectively. These quantities amount to only one-thirteenth to one-fifteenth of the total quantity of lactose contained in the milk.

If the influence exercised by the insoluble calcium salts in milk is slight, that which they exercise in cheese is of greater significance. The curdling of the milk on the addition of rennet naturally causes all insoluble substances to be precipitated, so that in the curd we find all those neutralizers of which mention was made. As fresh cheese is usually about half curd and half whey, the conditions in it differ from those in milk. While milk sugar predominates in milk, the reverse is the case in cheese. Here the insoluble substances predominate, and very strongly, too, as every kilogram of cheese contains 500 grams of curd against 500 grams of whey or 25 grams of milk sugar.

In the light of these figures it is quite clear that there are such large quantities of insoluble calcium salts that the greater part of the lactic acid that can be formed out of the 25 grams of lactose can be neutralized by them. Since 22 liters of milk, on an average, are needed to make an Edam cheese, the insoluble calcium compounds contained in that quantity are found in the curd. As was said above, the amount of undissolved calcium in the milk of Dutch cows is 0.1266 grams CaO per 100 cubic centimeters. In this case the curd would therefore contain 220×0.1266 grams$=27.85$ grams CaO. Now, if we take the conditions least favorable to combination by supposing that this calcium occurs as bicalcium phosphate, $Ca_2H_2P_2O_8$, so that only half of it can act as a neutralizer, then only about 14 grams of CaO would be present in this case to combine with the acid formed out of 42 grams of milk sugar. As a small Edam cheese weighs about 2 kilograms, about 21 grams of the 25 grams of milk sugar that the cheese contains per kilogram would, on conversion into lactic acid, be neutralized by the calcium salts alone.

If this is the case when the conditions are taken as unfavorable as possible for the salts to combine with lactic acid, and when the paracasein is left out of consideration, it will be seen that very little free lactic acid will be present in a normal Edam cheese and that the lactic fermentation may be allowed to proceed till all the milk sugar has been converted into lactic acid. The speed at which this takes place will, however, depend on the number and the virulence of the lactic acid ferments. It is true that these will grow into colonies, but as the nature of the nutritive medium—i. e., the curd—compels them to remain where the mother cell was, different centers will be formed, from which the lactic acid will spread and which the milk sugar will reach by diffusion. The exhaustion of the nutritive medium with regard to the milk sugar therefore depends on the number and the virulence of the colonies, and consequently of the lactic acid bacteria in the milk.

The greater the number of these organisms the sooner will the exhaustion follow, and as it is desirable that it follow quickly, lactic acid ferments in the form of normal or ropy whey are added to the milk in cheese making. The reason that it is considered desirable from a practical point of view that the lactic fermentation should be rapid is not far to seek. The disappearance of the lactose, the influence of the monocalcium phosphate and the lactic acid, and the combining of the paracasein with lactic acid produce a sour medium, thereby rendering the existence of a very great number of bacteria impossible, owing, on the one hand, to the removal of the milk sugar, which supplies the carbon needed for their sustenance, and, on the other hand, to the production of a sour medium which is inimical to their growth.

While in milk the lactic acid that was formed played the principal rôle in the disappearance of a great number of bacteria, there are other factors at work in cheese, and here the main factor is the disappearance of the lactose. This, however, has consequences which are fatal to the real lactic ferments themselves. These also need milk sugar for the supply of carbon and the gradual decrease of this substance renders less favorable the conditions for the life of the lactic ferments until their growth is at length stopped by want of food. The death of these organisms does not result at once, however, but only a transition to a condition of latent life.

This may be shown in a simple manner. If cheeses of different ages are examined by means of whey gelatin—that is to say, in a medium that contains milk sugar—it appears, when the cheese is not too old, that only colonies of lactic ferments are formed. This proves that the other organisms which were to be found in the milk have died, but it does not prove that the lactic ferments are still active, because whey gelatin is a medium which supplies milk sugar to them and thus causes them to become active again and to grow into colonies. If we take a gelatin obtained by making an extract from cheese—that is to say, a nutritive medium which differs as little as possible from cheese—no real lactic ferments are found. Hence, they are not dead in the cheese, but their activity is suspended. On further examination by means of cheese gelatin or cheese bouillon we always find that the bacteria which afterwards appear in Edam cheese are of a kind which might be called facultative ferments. They are distinguished from the real lactic ferments in the cheese, which are diplococci or streptococci, by their rodlike shape and especially by their property of being able to form lactic acid in media which contain milk sugar without depending on lactose for their growth. These species can, therefore, go on developing after the milk sugar has disappeared from the cheese.

The number of colonies of these organisms in the cheese depends, as in the case of the real lactic ferments, on the number of bacteria present in the milk; but, on the whole, their number is very small in comparison with that of the real lactic ferments. As a result of their property of using milk sugar as a source of carbon, these rod-shaped bacteria are also able to form colonies on whey gelatin. That they are very seldom found on this nutritive medium in the case of young cheeses may be accounted for by their smaller number and slower growth having caused them to be supplanted by the real lactic ferments. In examining older cheeses, however, in which the lactic ferments have begun to die off, we find that the rod-shaped facultative lactic ferments, having no longer been hindered in their growth, are the more numerous in the colonies that appear, the older the cheese. Although these organisms also die off, the life of some is very long. In cheeses which were 15 months old they could still be shown to be present by inoculating with a large quantity.

To sum up, the bacteriological process in a cheese is as follows: There is first a preinfection, when bacteria get into the milk as it is drawn; next there is an intense lactic fermentation which stops the previous infection, but is, after a short time, arrested by want of milk sugar; after this only facultative lactic acid bacteria develop in the cheese. Other bacteria of normal occurrence have so far not been found in Dutch cheeses.

Let us now examine the influence of the different microorganisms in the ripening of cheese and begin with those which cause the preinfection. As we have seen, although they are soon destroyed, yet they are for some time present in a living condition. As they secrete proteolytic enzymes, the curd will contain a certain amount of these. Besides, they may also produce so-called endoenzymes which they seem to leave behind in the cheese when they die. It is supposed that the walls of the cells at length burst and the contents of the cells, which contain enzymes that can not diffuse through the walls, come out, allowing the enzymes to act.

These two kinds of enzymes, though the quantity is small, may gradually begin to exercise some influence on the material of the cheese, and as the ripening requires a rather long time, at least from three to six months, it is not impossible that the preinfection plays some part in it.

The effect of the lactic acid ferments on the ripening process is very important, and they exercise their influence in various directions. In the first place, they cause the bacteria of the preinfection to succumb. Secondly, they sour the medium in a very short time, making it unfit for any putrefying bacteria, as these want a neutral or alkaline medium for their development. That the entire absence of lactic acid causes the ripening to fail absolutely can easily be shown. If all the milk sugar is washed out of the curd with water at a temperature of 30° C., and the curd is then made into cheese, after adding an emulsion of young cheese so as to insure the presence of all the necessary organisms, we get a product which is not like cheese at all, but is in a rotten condition. The absence of milk sugar prevents the lactic fermentation, the medium is not soured, and putrefying bacteria can develop.

Thirdly, the lactic acid ferments make it possible for the enzymes in the rennet to exercise their influence. Although investigators are not yet agreed as to whether pepsin and chymosin are identical, it has long since been proved by Babcock and Russell, and van Dam that rennet, whether through the chymosin or through the pepsin it contains, is a proteolytic agent in an acid solution. As it is the lactic acid ferments that sour the mass, it is due to these that the rennet can act on the paracasein.

Besides these influences of the lactic acid ferments which might be called biological, there are others which are chemical. As was said above, the lactic acid acts on the calcium phosphates and the paracaseinates of the curd; and it is this action, joined to that of the salt added in salting the curd, that gives the requisite degree of softness to the cheese.

The rod-shaped, facultative, lactic acid ferments may help to convert the milk sugar in the beginning of the ripening process, and as they remain in an active condition continue their action afterwards. They seem to make the cheese more plastic, but the exact nature of their action has not as yet been ascertained.

The question now arises whether the microorganisms we have dealt with are jointly the cause of all those chemical actions in the curd which are together designated by the term "cheese ripening."

To find the answer to this question we may start from aseptically drawn milk. When a cow is milked after the necessary precautionary measures have been taken to keep the milk from being infected—that is to say, after washing the udder, first in the usual way and then with a 3 per cent solution of boric acid, after cleaning the milker's hands in the same way, and after preparing sterilized pails to receive the milk in the separate stable where the milking takes place—milk is obtained which contains very few bacteria, about 150 per cubic centimeter. If we try to make cheese from such milk, no ripening takes place at all. Even after months the mass retains the aspect and the taste of curd. By adding pure cultures of the different microorganisms to such milk we can examine how far they are the cause of the ripening. When this is done it is found that by using lactic acid bacteria and the rod-shaped bacteria we can get a cheese which looks like a properly ripened cheese, but the characteristic taste and flavor of cheese are found to be wanting. Nor does the addition of the bacteria which cause the preinfection alter the result.

We may conclude from this that the ripening consists of two successive or parallel processes—one of which is the development of the peculiar consistency of the cheese, caused by lactic acid ferments and rod-shaped bacteria, and the other the development of the flavor and taste. That the rennet plays no part in the latter process results from the fact that cheeses in which only lactic ferments are present and which therefore contain a sufficient amount of acid for the action of the rennet enzyme do not go through all the stages of the ripening process.

Of the two stages or phases into which the ripening process may be divided, the earlier, the lactic fermentation, has by many different investigations been cleared up; of the later, which comprises the cause and development of the flavor and the taste, the same can not be said. Various hypotheses have been formed, but so far no definite result has been achieved.

In view of the fact that the early phase of the ripening takes only a few days, whilst the development of the taste and flavor requires from three to six months, there can be no doubt that the microorganism which causes them can keep alive in the medium the cheese offers after the first phase. The properties this ferment must possess to be able to cause the changes—in other words, to be able to live in the cheese—are the following:

1. That it needs no oxygen. The lactic-acid ferments soon use up the air that is present in the curd. In the case of cheeses made by the addition of pure cultures of bacteria the oxygen disappears even while the cheese is under the press.
2. That it needs no milk sugar.
3. That it can live in a sour medium, since the cheese continues to react as an acid.
4. That it can live in a medium containing a strong solution of salt, since the cheese contains about 5 per cent of common salt in the water.

Now, if we examine cheeses in various stages of ripening anaerobically, using cheese bouillon made by making an extract of young cheese with one and one-half times its weight in water, and evaporating the filtrate to one-fourth its volume in order to get the original composition of the watery solution in the cheese, the rod-shaped bacteria mentioned above will always be found on inoculating in the usual way. As we said, however, it is not these bacteria that cause the taste and flavor of cheese, so that further experiments will be necessary to ascertain what organism causes these properties of cheese.

L'INFLUENCE DE L'ACIDIFICATION DU LAIT SUR LE CONTENU DE L'EAU DANS LE FROMAGE BLANC.

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La teneur de l'eau dans le fromage blanc joue un rôle important dans sa préparation. La quantité d'eau ne doit pas dépasser une certaine limite, afin qu'on ne puisse reprocher la falsification de la marchandise par l'eau; d'un autre côté, on ne doit pas préparer du fromage blanc très sec parce qu'on en diminue son rendement et parfois son application.

Dans les conditions normales on obtient le fromage blanc dont le contenu d'eau n'atteint pas 70 pour cent. Il arrive dans la pratique que parfois on prépare le fromage blanc et même pendant la manipulation correcte avec une teneur d'eau anormale. On reçoit un produit très sec avec une très petite quantité d'eau ou un produit très aqueux. Ces cas irréguliers ne sont pas provoqués par l'acidification normale du lait, par l'influence des bonnes variétés de bactéries type *Bacterium lactis acidi*, mais par une acidification nuisible du lait à température plus élevée par bactéries type *Bacterium coli commune* et spécialement dans le lait pasteurisé par les bactéries butyriques.

C'est une idée dans la pratique, que son influence diminue la teneur de l'eau dans le fromage blanc et naturellement aussi le rendement. Pendant l'influence des bactéries butyriques cette circonstance est évidente, parce que le lait fermenté butyrique donne un coagulum sec, pénétré de petits trous.

Pour me persuader de l'influence de diverses fermentations du lait sur la quantité de l'eau dans le fromage blanc, j'ai exécuté une série d'essais avec une production de fromage blanc. J'ai soumis le lait maigre (dans chaque cas un tiers 1) après la pasteurisation (une demi-heure à la vapeur courante), aux diverses fermentations à une température de 30° C. sous les mêmes conditions. La première série d'essais concernait la fermentation lactique, par le levain de la crême, contenant un mélange de variétés de type *Bacterium lactis acidi* en cultures pures. Le lait se coagulait en 18 à 20 heures. Dans la deuxième série d'essais j'ai employé la culture pure de *Bacterium coli commune*. La coagulation s'est produite en 20 à 22 heures. Enfin, pour la troisième série j'ai laissé transformer le lait par la fermentation butyrique. La coagulation durait 30 heures. Lorsqu'il a été tourné on a réchauffé le lait à une température de 35°–40° C. pendant une heure, et après la séparation de petit-lait on a pressé le fromage blanc pendant deux heures (20 kg. sur 1 kg. de fromage blanc).

J'ai d'abord préparé le fromage blanc du lait pasteurisé par l'addition d'un bon levain de la crême. On a employé sept échantillons de lait. Le fromage blanc que nous avons obtenu était d'une consistence plus dure, son goût et son odeur étaient agréables. Tout de suite après le pressage, j'ai dosé le contenu de l'eau au moyen de sable marin et de l'étuve chauffée à une température de 100° C. Le résultant est marqué dans le Tableau No. 1.

TABLEAU No. 1.

Echantillon No.	1	2	3	4	5	6	7
Contenu de l'eau (pour cent)	63.27	64.22	52.09	63.60	56.01	64.32	61.23

Minimum, 52.09 pour cent; maximum, 64.32 pour cent; moyenne, 60.68 pour cent.

Un coup d'œil jeté sur le Tableau No. 1 montre que le contenu de l'eau dans le fromage blanc obtenu par l'acidification lactique normale est, dans la majeure partie des cas, plus élevé que de 60 pour cent, mais moins que de 65 pour cent, avec un chiffre moyen de 60.68 pour cent.

Ayant ainsi acquis le matériel comparatif normal, j'ai alors commencé la deuxième série d'essais, c'est-à-dire l'observation de diverses fermentations normales. Au premier rang, il serait très intéressant d'examiner comment se comportent les bactéries type *Bacterium lactis acidi*, de ces variétés qui préservent la présure et sont la cause de la maladie du lait nommée coagulation prématurée (Gorini). Mais le manque de culture virulente m'empêchait d'exécuter ces essais. C'est pour-quoi j'ai fondé la deuxième série par la fermentation de *Bacterium coli commune* dans le lait pasteurisé sous les mêmes conditions que dans la série première. Le coagulum obtenu séparait le petit-lait et, dans la plupart des cas, il était percé de petites bulles de gaz. Le coagulum n'était pas resserré, mais très aqueux, et avait une odeur de marais. Par le réchauffage il est devenu très souvent floconneux et c'est pourquoi le fromage blanc subissait une perte en passant par la toile. On a obtenu un fromage blanc boueux, à consistence fine d'une odeur et d'un goût de marais. On remarque la teneur de l'eau dans le Tableau 2.

TABLEAU No. 2.

Echantillon No.	1	2	3	4	5	6	7	8	9	10	11	12
Contenu de l'eau (pour cent)	68.15	68.73	70.96	63.88	76.48	77.18	77.20	66.02	81.41	67.38	68.63	64.68

Minimum, 63.88 pour cent; maximum, 81.41 pour cent; moyenne, 70.89 pour cent.

D'après ce tableau on voit que les fromages blancs obtenus dans la série deuxième contiennent beaucoup plus d'eau que ceux de la série première. La teneur maximale fait 81.41 pour cent, la minimale 63.88 pour cent, la moyenne 70.89 pour cent. Dans cette circonstance, il faut remarquer que le pressage était plus grand que dans les procédés normaux. De ces observations il résulte que la participation des bactéries type *Bacterium coli commune* à l'acidification du lait augmente la teneur de l'eau dans le fromage blanc.

La plus grande capacité pour tenir l'eau a été causée par un changement de la caséine plus profond que celui effectué par l'acidification normale. On peut s'en persuader par l'observation des albuminoides du petit-lait. Quoique le lait ait été pasteurisé (une demi-heure à 100° C.) et qu'il ait eu de l'albumine dénaturé qui se trouvait dans le coagulum, le petit-lait a donné, par l'ébullition, un précipité floconneux, et pourtant le liquide filtré se précipite par l'alcool (68 pour cent). Lex deux précipités lavés à l'eau ont donneé par la calcination des cendres qui contiennent de l'acide phosphorique.

Le précipité qui s'est formé par l'ébullition avait 15.06 pour cent de nitrogène, donc l'albuminoide était très proche de la caséine. De ces observations il résulte que la caséine dans ce cas est soumise à un plus grand changement que pendant l'acidification normale.

La dernière série d'essais a été exécutée par les échantillons de lait fermenté au moyen de bactéries butyriques. Le coagulum était dans tous les cas ratatiné, percé de plusieurs petites bulles de gaz et avait une odeur forte d'acide butyrique. Après le réchauffage et le pressage on a obtenu le fromage blanc qui, dans la majeure partie des cas, était sec d'un caractère de peau, d'un goût désagréable amer. La teneur de l'eau est évidente au Tableau No. 3.

TABLEAU No. 3.

Eschantillon No.	1	2	3	4	5	6	7	8	9
Contenu de l' eau (pour cent)..........	49.64	47.25	48.82	62.46	59.75	58.64	57.78	55.89	60.41

Minimum, 47.25 pour cent; Maximum, 62.46 pour cent; Moyenne, 55.62 pour cent.

D'apres les résultats de ces analyses, la fermentation butyrique diminue le contenu de l'eau dans le fromage blanc. Le minimum de 47.25 pour cent est vraiment très bas et d'après le tableau il est encore évident que le tiers des échantillons possède une teneur d'eau très proche à ce minimum, tandis qu'un nombre moindre de ces cas approche du maximum 62.46 pour cent. La quantité moyenne d'eau 55.62 pour cent est aussi basse et c'est pourquoi le rendement de ce fromage blanc est très petit.

Les résultats des essais démontrent que par l'influence de l'acidification anormale du lait il se forme un fromage blanc qui n'est pas d'accord avec les exigences concernant le goût et principalement le rendement. Tandis que par l'influence de la fermentation butyrique on peut obtenir le fromage blanc avec une si petite quantité d'eau que le rendement en est diminué, on peut par la fermentation du lait provoquée par *Bacterium coli commune* obtenir un fromage blanc si aqueux que la toile le retient très difficilement et il ne peut devenir un objet de commerce normal. On a trouvé ces relations dans les cas où les fermentations introduites étaient prédominantes. Bien que leur influence soit diminuée, elles peuvent provoquer mêmes dans ces cas où elles passent pour fermentations secondaires suivant la fermentation lactique normale. Ces cas se présentent à la température plus élevée pendant le transport, quand le lait tourne prématurément. Cette influence est d'autant plus grande que ces microorganismes nuisibles se multiplient (*Bacterium coli* et bactéries butyriques) sur le compte des bactéries lactiques.

[Abstract.]

INFLUENCE OF THE ACIDIFICATION OF MILK ON THE WATER CONTENT OF WHITE CHEESE.

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From observations made on cheese made from skimmed and Pasteurized milk it has been demonstrated that the fermentation of milk has an influence upon the amount of water in white cheese. While the bacteria of the type *Bact. lactis acidi* give a normal percentage of water in white cheese *Bacterium coli* fermentations generally produce a very watery curd, and butyric fermentations cause very dry white cheese.

EXPERIMENTS IN THE MANUFACTURE OF RENNET EXTRACT.

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Rennet extract as used in the dairy industry is obtained from the fourth stomach of the suckling calf; the stomachs of other ruminants are rarely used, and only then by small crofters in the preparation of homemade rennet.

Commercial rennet is now almost exclusively used in the making of hard-pressed cheeses, but makers of soft cheeses usually prefer to prepare their own extract, on which they place a high value.

The process of rennet making on a factory scale has not for obvious reasons been communicated to scientific journals, and little appears to be known of the methods of extraction and clarification which are of service on a large scale.

Experiments on the manufacture of rennet on an extended basis were carried out for three successive years by the dairy research department of the West of Scotland Agricultural College; during the seasons 1919 and 1920, over 3,000 gallons were successfully prepared according to our formula and issued to the dairy industry. In practice, the rennet gave excellent results. The following description summarizes the results of our work.

The stages of importance in rennet making are:

(1) The preparation of the raw material.
(2) The process of extraction.
(3) The method of clarification and preservation.

Rennet makers use the cured vells of commerce, which originate chiefly in Russia, Siberia, Bavaria, and Czechoslovakia. These dried vells are very convenient to handle, and keep well in cold storage, but they vary greatly in yield, and frequently contain bacteria of the most undesirable type. Thus we have found that *B. subtilis*, representatives of the *B. coli* group, and staphylococci occur almost invariably in the extracts of commercial vells, and there is no doubt that some common cheese faults can be traced to the bacterial flora of the rennet.

Good results in rennet making may be got by employing carefully handled material of home origin and treating it after the following manner: As soon as possible after the slaughter of the calves at the abattoir, the fourth stomachs are severed from the rest of the intestines and conveyed to the factory in waterproof bags. The mesenteric membranes and the adhering fatty tissue are now removed with a trimming knife, the curdled milk and liquid contents of the stomach expressed with the finger and thumb, and the stomach inflated. Some manufacturers make an extract of the partially digested stomach contents and recover therefrom the enzyme secreted in the hours before slaughter.

The distended membranes are rapidly air-dried at a temperature between 20° and 25° C. for 10 days, and then kilned at 30° to 35° C. for a further period. Stomachs cured in this way are tough and pliable but not brittle. Effective drying of the vells greatly diminishes the amount of mucus which emerges during the subsequent extraction, and thus renders filtration easier. The fresh vells may be salted before being distended. Such vells keep well and are not attacked by rats or mice as are unsalted vells, but they absorb moisture in a damp atmosphere to the detriment of the extract.

The dried vells are cut up with a mincing or slicing machine and added to the extracting fluid at the rate of 8 to 10 vells per gallon of water.

The composition of the extracting fluid is of first importance. A simple extraction with brine gives good results, from 5 to 10 per cent of salt being employed. A combined salt and calcium chloride extraction (5 per cent each) is also very effective, especially with vells which have been cured for a short period only. It is important that the extracting fluid be maintained near the neutral point. Acid extractions are turbid, difficult to filter, and do not keep well. To maintain this proximate neutrality, either precipitated chalk or bicarbonate of soda in regulated amount may be used. The pH value of the extracting fluid should lie between 6.0 and 6.4. If commercial vells are employed, a preservative is necessary to restrict the fermentation due to microbial action, and for this purpose boric acid is universally used at the rate of 2 to 3 per cent. Thymol crystals are occasionally employed. Boric acid activates as well as preserves the rennet extract. In our work, and especially with home-cured vells we have found that it is better to withhold the boric acid until the extraction process is complete.

When the extract is sufficiently strong, the extracting fluid is decanted. At this stage it may be partially clarified by centrifugalization or by filtering through calico, more especially if the extract be thick and slimy.

The fluid is now additioned with glycerin, and from 5 to 10 per cent salt (or until the salinity of the extract is approximately 14 Beaumé), but the glycerin may be omitted if the rennet at this stage is fairly clear and is to be marketed soon. Boric acid, if not previously added, is mixed with the glycerin and added along with the salt. The addition of salt at this juncture causes a slow precipitation.

The extract thus treated is allowed to sediment, preferably out of contact with air. In a few weeks, the clear rennet may be siphoned off and stored in jars or in barrels. (Some manufacturers sediment rennet extracts in bulk for two or three months.) If the rennet shows no signs of incipient clearing after two or three weeks, it must be filtered. Clarifying agents like zinc dust, kieselguhr, powdered chalk, kaolin, and talc added to a turbid rennet are of little service in clearing the solution. Most of them absorb a good deal of the enzyme without having any effect on the clarity.

The majority of filters possess a strong adsorbing power for rennet. If the turbidity is removed by a filter press of the ordinary type, much of the enzyme is retained by the filter, and the resulting rennet is weak. On a small scale, Chardin paper and gravity filtration will give good results. It may be observed that a clear rennet is not obtained until the pores of the filter become partially blocked up, or until a semipermeable membrane forms over its surface. Charcoal filters possess the greatest adsorbing powers for the enzyme, and have no utility in rennet manufacture. We have found that a sectioned filter, in which close and loose layers follow one another, gives a clear extract, and if constructed of proper filtering materials, removes comparatively little enzyme. Filtration through salt or kainit will clear very turbid solutions, but a very considerable amount of the ferment is lost. Filtration through suitable grades of silver sand gives excellent results.

The turbidity of fresh rennet extracts, which is caused by the presence of mucus of a nucleo-protein nature, may also be removed by common protein precipitants or coagulants. Unfortunately, with the possible exception of salt, few of these are of any service, because heavy precipitation, while it removes the mucus, at the same time removes much of the enzyme. Lactic acid at the rate of 0.05 per cent, sweet cheese whey of an acidity not more than 0.02 per cent, and 2 per cent boiled milk are among the most useful precipitants. These agents if judiciously employed cause a relatively small loss of enzyme. They usually take from 14 to 21 days to clear the solution.

The exact form in which the rennet enzyme occurs in the extract is difficult to determine, but it is clear from examination that it is in colloidal and not in simple solution. If it were possible to isolate the pure enzyme, and then add it to distilled water, one would find that such a solution would quickly deteriorate. The enzyme must have some suitable agent with which to associate, and this must be a colloid or of a gelatinous nature.

Most rennet extracts are colored with a salt-saturated caramel solution, but neutral annatto and bismark brown may also be used. These agents are said to exercise a protective action by excluding certain harmful light rays, but it is doubtful if they have any utility in commercially prepared extracts. In any case, rennet is mostly stored in barrels or in stone jars, and is seldom exposed to light long enough for the light to exercise any destructive effect.

Rennet in bulk or in jars should be kept at a low temperature. At temperatures above 60° F. the loss of strength is accelerated. As far as possible oxidation should be guarded against; exposure to air undoubtedly increases the loss during keeping. If a large surface of a bulk sample is necessarily exposed during prolonged sedimentation, a layer of liquid paraffin on the top will prove helpful.

The degradation of rennet extracts during storage is caused by several factors, among which oxidation effects and the action of microorganisms are the chief. These microorganisms, which include members of the coliform and the anthracoid group and more than one species of yeast, are also inimical to quality in cheese.

MONGOLIAN CHEESE, OR "NAII TOFU."

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The Mongolian cheese, or Naii Tofu, is made in a primitive method during the summer season when the milk is abundantly secreted. First of all, the milk is coagulated by the natural lactic fermentation, and after the whey is separated the coagulated casein is taken out to be boiled and stirred up in a kettle until its serum evaporates and its viscosity increases. It is then put in a wooden box and cooled for a short time to be again coagulated; and, when it is taken out and dried in the sun, it is ready to be preserved in a receptacle.

The soft-dried Naii Tofu is good to eat, but the hard-dried form is to be boiled or roasted. It is said that the Naii Tofu is a necessary companion of Mongolians when they go out hunting or traveling.

The sample used in the writer's experiment was of an oblong shape, 16 to 19 centimeters in length, 9 to 9.5 centimeters in width, and 1.52 centimeters in thickness, weighing 0.274 to 0.38 kilo. It was very hard and yellowish. The analysis made showed that it contained 12.630 per cent of water, 22.400 per cent of fat, 62.228 per cent of protein, etc., and 3.290 per cent of total ash. As to the soluble nitrogenous compounds, it showed when water-free 1.98 per cent of soluble nitrogen, 0.259 per cent of ammoniacal nitrogen, 0.481 per cent of soluble protein nitrogen, and 1.244 per cent of amide nitrogen.

The above is the result of the analysis made on one sample only. To get a precise result on each compound, more experiments on various samples are required.

SESSION 8. EXTENSION METHODS IN DAIRY EDUCATION.

Honorary chairman, MAGNUS CHRISTIANSEN, professor, Royal Technical Agricultural College, Copenhagen, Denmark.

Chairman, K. L. HATCH, assistant director, agricultural extension, University of Wisconsin.

Secretary, E. V. ELLINGTON, head of department of dairy husbandry, State College of Washington.

Y. W. C. A. ASSEMBLY HALL,
Syracuse, N. Y., Friday, October 5, 1923—1.30 p. m.

Chairman HATCH. The eighth session of the World's Dairy Congress will now come to order.

I want to present Professor Christiansen, professor at the Royal Technical Agricultural College, Copenhagen, Denmark, who will act as our honorary chairman. [Applause.]

Of course most of you gentlemen from the States are acquainted with our secretary, Mr. Ellington.

With these distinguished gentlemen on my right and left for support, we are certain that your chairman this afternoon will be able to at least read the program.

The directions for the conduct of the program (which was delayed by the late arrival of the trains and adjourned to this hour this afternoon) are to proceed in the order in which the numbers appear on the program. When the author of any paper does not appear in person, the paper will go to the end of the list. We will proceed in the order as announced.

Inasmuch as Professor Borland is the first speaker present to read his paper, I now have the pleasure of introducing to you Professor Borland, head of the department of dairy husbandry, Pennsylvania State College. Professor Borland.

AGRICULTURAL EXTENSION METHODS AND ACTIVITIES.

ANDREW ALLEN BORLAND, head of department of dairy husbandry, Pennsylvania State College, State College, Pa.

Agricultural extension work consists in the instruction of those who are not resident students at an educational institution. It presents to such persons the teachings of the colleges of agriculture and the findings of the experiment stations by means of field demonstration, publications, and otherwise.

Prior to 1914 agricultural extension work was carried on in a general way by means of farmer's institutes, correspondence courses, lectures, and farm visits by members of the instructional and experimental staffs of the agricultural colleges and by a few county agricultural agents. The Smith-Lever Act, passed by Congress May 8, 1914, provided a definite basis for a permanent national system of agricultural extension work, including practical instruction and demonstrations in agriculture and home economics, to be carried on by the State agricultural colleges in cooperation with the United States Department of Agriculture.

The act provides for instruction in the economical production of farm products and in securing better markets and fairer prices for the same. It is not the province, however, of the extension service to act directly as buying or selling agent for the farmer, any more than it is to grow and harvest crops for him. The extension service is advisory in character and should furnish information the application of which will bring better results both in the production and in the marketing of farm products.

ORGANIZATION.

The Nation.—Cooperative extension work in agriculture and home economics is supervised nationally by the United States Department of Agriculture. The director of extension service at the State agricultural college submits to the United States Secretary of Agriculture, for approval, projects of all proposed extension work for that particular State. After the projects are approved the Secretary of Agriculture certifies to the United States Treasurer that the State is entitled to receive the funds allotted to it.

The State.—Within the various States extension work in agriculture and home economics is administered by an extension division established in connection with the State agricultural college. The extension division is headed by an extension director under whose supervision various men are in charge of different lines of work. In some States the extension activities are classified as county agent work, club work, specialists' work, etc. In other States the more satisfactory classification for the purpose of efficient administration appears to be in terms of subject matter, as dairying, poultry, agronomy, etc. The production and distribution of farm products are largely on a subject-matter basis, and by proper organization of the personnel all persons engaged in extension work along a particular subject line may be united for the development of that particular industry.

An extension specialist is in charge of a particular line of subject-matter work and is responsible for its development within the State. He furnishes the facts and technical information needed to make the work effective. He supervises the work and, when needed, assists the county agent in carrying out the projects on that particular activity in a county. He is responsible for records of the work done along his line and for making up a State report of the same.

A State club leader and his assistants look after the organization part of junior or club work. Junior activities, in so far as they include subject matter, receive attention from a specialist in that particular line the same as the work for the farmers. The county agricultural agent has immediate supervision of the club work in a county in some States, and, in others, county club agents supervise the club work. This, with other lines of activities, make up the county program of work.

The form of organization of extension work has many minor modifications in different States, but generally speaking the foregoing is typical.

PERSONNEL.

The number of persons engaged in cooperative extension work on July 1, 1922, was as follows:

County agricultural agents	2, 433
Home demonstration agents	975
Boys' and girls' club work	328
Total including specialists and others	4, 487

Of the 3,044 counties in the United States reporting agricultural products, 2,103, or 69 per cent, had men county extension agents and 801, or 26 per cent, had women county extension agents.

FUNDS.

The Smith-Lever Act provided that each State should receive $10,000 annually for cooperative extension work in agriculture and home economics, making a total of $480,000 annually beginning with the fiscal year 1914–15. For the year 1915–16, an additional $600,000 was to be distributed among the States in the proportion that the rural population of that State bears to the total rural population of all the States according to the last census. An additional $500,000 more than the appropriation for the last preceding year was to be made each year up to 1922–23 when the total annual amount available to the States was to be $4,580,000. However, no payment of the appropriation other than the original $10,000 to each State was to be made in any year to any State until an equal sum had been appropriated by the legislature of such State or provided by State, county, college, local authority, or individual contributions from within the State.

THE COUNTY.

In many States county organizations called farm bureaus have been developed to support the county agents in their work. Membership may include any person interested in better farming. The executive committee of the farm bureau arranges for local expenses of county agent work, including travel within the county, office expenses, etc., and its committees assist the county agent in carrying out the county program of work.

In other States the local responsibility is placed upon community organization of farmers. A central county organization deals in cooperation with the county agent with such problems as are countywide.

The county agricultural agent is the local representative of the extension service. It is his duty to bring to the farmers in the county the results of scientific investigation and the experience of successful farmers, and by such information and demonstrations influence farmers generally to put into operation the best agricultural practices. He is expected to assist all economic and social forces working for the improvement of agriculture and country life. He gives instruction not only in improved production methods but also in the economics of agriculture. He works as far as possible through existing agencies and organizations such as the Grange, farmers' unions, and community clubs. He may also aid in forming new organizations to benefit the agricultural interests of the county.

THE COMMUNITY.

A community usually represents a territory that has a common trading center, or other common interest such as a centralized township school. In localities where natural centers are lacking the township is used as the community unit.

It has been found essential to community progress that the people of a community take upon themselves some responsibilities in deciding the particular line of extension work that should be undertaken, and the methods by which it is to be carried on; also for doing some of the actual work in accomplishing the results.

Definite aims and purposes are outlined in a specific program for the community. In the development of the program the county agent meets with representatives of the community, or else a meeting is held where the problems of the community are discussed and three or four of the major needs are selected as the program of work for the ensuing year. An active farmer is selected as the leader for each particular project in the community. It is his duty to locate suitable farms or herds for demonstration purposes, keep the executive committee and the county agent informed as to the progress of the project, and advance this particular activity in the community in every possible way.

The sum of the community programs makes up the county program which the county executive committee approves and follows up throughout the year.

To the accomplishment of this program are enlisted the energies of the executive committee, the county agent, the extension specialists, the leaders in the respective lines of work in the communities in the county, and all other extension agencies connected in any way with the projects adopted by the various committees. Each person has his own part to do, and all are expected to unite in an endeavor to accomplish a definite result.

With the adoption of a definite program for each county, information is at hand at the beginning of the year as to how much help will be needed for the specialists in different lines of work, and plans for the extension work of the State as a whole can readily be made. The extension service thus grows in the character and number of extension specialists as the needs of the State develop.

At the beginning of the year the projects for each community are charted and the names of the committee leaders shown. Throughout the year close touch is maintained with the program by all persons connected with the projects, and at the close of the year the program is checked by the community leaders, a county agent, and the extension specialist to show what has been accomplished in the communities, the counties, and the State during the year.

Since it will be impossible within the limits of this paper to discuss in detail the methods and activities of all the various lines of work, the remainder of this paper will be devoted to some of the more outstanding dairy extension activities.

COOPERATIVE BULL ASSOCIATIONS.

In the United States one of the most important projects in dairy extension work is the cooperative bull association. In these associations, as is well known, the number of dairymen owning a total of about 70 cows and living within a radius of 2 or 3 miles, form a "bloc." Two or more similar blocs compose the association. A sufficient number of high-class bulls are purchased to furnish one to each bloc. At the end of every two years the bulls are rotated from bloc to bloc. If there are four blocs the bulls originally purchased serve the association for eight years. The cost varies in different associations. A rather common basis is $15 per cow. If there are 70 cows in a bloc, sufficient funds are available to purchase sires valued at $1,000 each. A man having 10 cows would thus invest $150, for which in a four-bloc association he would have part ownership in four $1,000 bulls, and through the rotation system would get the use of these high-class sires for eight years.

The plan of procedure in organizing such associations in a county is definitely outlined in project form, as are all other extension activities. The exact form and details of the projects differ in various States, but the following[1] will serve as a good example:

County project No. ________ Year ____________________.

Name: Improvement of dairy stock.

Object: To increase the number of registered bulls and high grade or registered dairy stock.

Method of procedure: This work will be carried on by means of junior and senior cooperators, with follow-up work by the county extension workers of ________________ County, in cooperation with the extension office, the dairy specialist, cooperators, and club members, in accordance with the following plan:

The State extension office and dairy specialist will—

1. Furnish agreement forms when necessary.
2. Furnish literature in regard to cooperative bull associations.
3. When requested to do so, furnish write-ups for local publications or circular letters in regard to the value of high-class, purebred bulls and high grade or registered stock.
4. Furnish suggestions on constitution and by-laws for the operation of cooperative bull associations.
5. Assist in locating desirable animals.
6. Publish a list of breeders of purebred dairy stock within the State.
7. Assist as far as possible with meetings arranged by county workers
8. Summarize results of work in the State as a guide to further procedure.

The county worker will—

1. Whenever and wherever possible, through meetings, personal contacts, etc., bring before the people, especially the dairymen, the advantages of keeping better dairy stock and the improvement of the dairy stock.
2. Secure cooperators to replace scrub bulls with registered bulls during the current year.
3. Attempt to import into the county __________ high grade or registered cows.
4. Secure _________ high grade or registered bred heifers, calves, or cows for junior cooperators.
5. Use every means possible to persuade prospective buyers to buy only subject to the tuberculin test for tuberculosis and the agglutination and complement fixation tests for abortion, and reject all animals showing positive tests; all animals to be tested before being imported, and the seller to furnish purchaser with certificate from some reliable laboratory showing results of each test.

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[1] New Mexico.

6. Where practical, will secure signers to an agreement to organize a cooperative bull association or to buy a community bull.
7. Will report to specialist the number of registered bulls and the number of cows, both grade and registered, purchased as a result of this work. When a registered bull has been purchased, he will report the number of cows in the purchaser's herd, and the number of neighbors with the size of their herds, that will have access to the bull.
8. Will give as great publicity as possible to the project.
9. Will notify the specialist by June 1, 1923, the approximate date and length of time he can be used to advantage in the county.

Junior cooperators will—

1. Carry on this project in accordance with the rules governing calf club work.

MEASUREMENT OF RESULTS.

Results will be measured in the county by—

1. Number, breed, sex, and age of animals secured.
2. Number of community associations and number of cooperative bull associations organized.
3. Number of cows affected in the herds of the owners of the purebred bulls, and their neighbors.
4. Improvement of herds.

Signed:

Date______________________________

____
County Extension Worker.

Date______________________________

____
Dairy Specialist.

Date______________________________

____
Director of Extension.

Date.	Cooperator.	Jr. or Sr.	Address.

Remarkable improvement has taken place in the type and production of the dairy cows in the community where these associations have been operating. For example, in one association the average production for 17 daughters of 3 bulls was 6,919 pounds of milk and 300.6 pounds butterfat, while that of the 17 dams was only 5,775 pounds of milk and 237.3 pounds of butterfat, an average increase of 1,144 pounds of milk and 63.3 pounds of butterfat for each daughter compared with her dam.

On July 1, 1922, there were 190 bull associations in the United States, with a total membership of 6,102. These associations owned 857 bulls, which were mated with 40,669 cows, of which 33,546 were purebred.

Through the efforts of dairy extension workers during the year 1921–22 there were 31,654 purebred sires of all kinds placed on farms not before having purebred sires, or to replace purebred sires of inferior quality. There were also 901 livestock breeders' associations organized, with a membership of 21,190.

COW-TESTING ASSOCIATIONS.

Much improvement has been made in the average yield of milk and butterfat per cow in herds in the cow-testing associations throughout the country. In these associations, as is well known, a man is hired to go from farm to farm monthly throughout the year. With one day's yield each month as a basis, he computes the yield, the value of the product, the cost of feed, the feed cost of milk and butterfat production, and the relation of the feed cost to the value of the product from each cow in the herd monthly throughout the year. The results give the owner reliable information as a basis for culling out unprofitable cows.

The importance of culling out low producers may be noted from figures computed by the United States Dairy Division, showing that on the average high-producing cows give much better returns above the cost of feed than low producers. The following table gives the data:

Relation of yield to returns above feed cost.

Pounds butterfat per cow, yearly.	Returns above feed cost per cow, yearly.
100	$10
150	26
200	42
250	58
300	74
350	90
400	106

The average yield per cow in the United States, according to the 1920 census, was only 3,412 pounds milk, containing approximately 140 pounds butterfat, while for the 2,234 cows in the testing associations the average yield was 6,977 pounds of milk and 248 pounds of butterfat.

Striking examples may be noted of the improved production taking place in herds where the low producers were culled out and their places filled with animals raised from the best cows in the herd and a purebred sire of high-producing ancestry. The following data from a herd in a Pennsylvania association will serve as an illustration:

Year.	Pounds milk per cow, yearly.	Pounds butterfat per cow, yearly.	Cost of feed per cow, yearly.	Returns above feed cost per cow, yearly.
1914–15	7,150	274	$45.90	$46.50
1915–16	7,067	273	44.89	59.74
1916–17	8,221	305	61.57	87.27
1918–19	9,109	346	120.16	197.42
1919–20	11,720	454.6	193.49	222.53

The owner of the herd started with 10 grade cows. He gradually replaced his inferior cows with other animals produced by mating his best cows with a good purebred bull. A marked improvement in yield was noticeable. He then got a start in purebreds and gradually disposed of his grades. In 1919 he sold the last of his grades and kept only purebreds thereafter. His herd of 8 purebred cows in 1920 averaged 11,720 pounds of milk, 454.5 pounds of butterfat, and after paying for their feed returned to their owner an average of $222.53 per cow.

On July 1, 1922, there were 513 cow-testing associations in the United States with 12,508 members owning 216,875 cows.

PUREBRED COWS.

Extension workers have been active in the introduction of purebred cows into the various communities adapted to dairying. During the year ending July 1, 1922, over 62,000 purebred females were placed on farms as foundation stock for purebred herds. Purebred cows are not only more valuable for breeding purposes than grades but are also considerably more productive for milk and butterfat purposes. The records from over 1,000 cows in testing associations in Bradford County, Pa., showed that on the average the purebred cows produced 17 per cent more milk and 15 per cent more butterfat than grades. These animals were all kept under very similar conditions and show what increase can normally be expected from purebreds. Other data including the yearly records of 11,086 grade cows and 1,704 purebred cows in testing associations throughout the United States indicate an increase of 10.4 per cent in the yield of butterfat from purebreds. The records were from cows of all ages. However, there was a larger proportion of mature cows among the grades than among the purebreds.

BOYS' AND GIRLS' DAIRY CATTLE CLUBS.

The increased interest in better livestock in many communities is directly traceable to boys' and girls' cattle clubs. Purebred calves are usually furnished at moderate cost by dairy cattle breeders' associations, banks, and other public-spirited organizations. Prizes are awarded at the close of the season to those whose calves give evidence of having received the best care. These calf clubs are often continued as cow clubs, or else the latter are organized at the outset with purebred dairy cows. In these cow clubs each member keeps a record of the production of his own cow. Milk-testing clubs are frequently conducted in connection with these cow clubs. The members meet once a month at a convenient place, bring samples of milk, test them, and record the data. During the year ending July 1, 1922, 8,626 boys and girls were engaged in club work with dairy cattle.

DAIRY CATTLE FEEDING.

Meetings with farmers for the discussion of feeding problems, balanced ration campaigns, schools of instruction in dairy cattle feeding lasting from two to five days, county meetings with the feed dealers associations, and monthly feeding news publications have all been used by the dairy extension specialists and the county agricultural agents to promote the knowledge and use of properly balanced and economical rations. During the year ending July 1, 1922, 50,355 farmers were assisted in computing balanced rations.

JUDGING.

Considerable time is given by extension workers during the summer and fall to the judging of dairy cattle at exhibits, fairs, and contests. This is an interesting and valuable educational feature of the cattle shows, inasmuch as the judge usually gives his reasons for the awards and thus helps to establish in the minds of those interested a standard as to what constitutes proper type in the different breeds.

DISEASE CONTROL.

Projects covering the control of animal diseases have formed an important part of dairy extension work. In some counties campaigns are in progress to have every herd in the county placed under State and Federal supervision for the eradication of tuberculosis. During the year ending July 1, 1922, there were 1,065,098 animals tested for tuberculosis through the cooperation of the State and Federal agencies. Much work was done in testing animals for contagious abortion by the agglutination and complement fixation test and 519,759 animals were treated for blackleg.

BETTER QUALITY OF DAIRY PRODUCTS.

Clean milk campaigns have been instrumental in greatly improving the quality of milk and cream delivered to producers. Sediment tests of the milk as it reaches the plant from each farm have been especially effective in pointing out to careless producers the need for greater care in the methods of production. Farm visits to advise dairymen personally concerning better equipment and methods have usually resulted in satisfactory improvements in the quality of milk.

In many States butter-scoring exhibits have been held. One or more pounds of butter have been sent by farmers and creameries for scoring, analysis, and criticism.

Much assistance has been given by extension workers in the organization of milk and dairy manufacturing plants, in the planning of dairy buildings, selection and arrangement of equipment, and in the handling of the raw material in the plant so as to put on the market dairy products of high quality.

MARKETING.

In most of the territory adjacent to the large milk-consuming centers, milk producers' organizations are in active operation. The officers of these organizations are charged with the responsibility of marketing the milk produced by the members. The association is supported by a small commission, usually 2 or 3 cents for each 100 pounds of milk sold. In order to stabilize the market, some of these organizations have purchased or built plants where milk or cream may be made into dairy manufactured products, and thus care for any periodical surplus.

In some of the smaller cities, farmers' cooperative milk plants have been organized through the assistance of the extension service. To this plant is brought most of the milk produced in the community. It is clarified, Pasteurized, bottled, and delivered by the central plant, and the surplus is made into dairy manufactured products. This plan eliminates much duplication of effort in preparing and delivering the product to the consumer. The extension representatives have also encouraged and assisted in the formation of cooperative dairy manufacturing establishments where the conditions warranted such organizations.

During the year ending July 1, 1922, the county agents gave assistance to 7,078 cooperative marketing associations of various kinds. These associations did $349,807,153 worth of business, with an estimated saving to farmers of $23,791,869.

INCREASING THE CONSUMPTION OF DAIRY PRODUCTS.

Campaigns for the increased consumption of dairy products have been carried on in many cities. By means of posters, newspaper articles, pamphlets, public meetings, health plays, moving pictures, exhibits, demonstrations, and the distribution of milk at public schools the consumption of milk has been greatly increased. In 10 of the larger cities the increase has run from 15 to 25 per cent. Striking evidence of the value of increased milk consumption by school children was noted in the decreased percentage of malnutrition subsequent to the milk campaign.

The extension service has accomplished much for the improvement of agriculture since the passage of the Smith-Lever Act in 1914. A considerable part of the increasing returns from land and livestock may be traced directly to the improved methods of production and marketing, demonstrated by the extension specialists, the county agricultural agents, the leaders of boys' and girls' clubs, and others engaged in extension work.

This definite Nation-wide plan of agricultural extension has been in operation only nine years. The work as a whole may yet be said to be in its infancy, and its beneficial results will continue to increase as the improved methods of production and marketing taught by extension workers become more generally adopted throughout the Nation.

Chairman Hatch. Inasmuch as the next speaker on the program has to be in another meeting, over which he is presiding, we will postpone discussion on Professor Borland's paper until after the presentation of the next topic by Mr. J. H. Frandsen, who is editor in chief of the Journal of Dairy Science and dairy editor of Capper Farm Press. I am pleased to present Mr. Frandsen to discuss the matter of "Methods of disseminating results of research concerning the dairy industry by publications." Mr. Frandsen. [Applause.]

METHODS OF DISSEMINATING RESULTS OF RESEARCH CONCERNING THE DAIRY INDUSTRY BY PUBLICATIONS.

Julius Herman Frandsen, editor in chief, The Journal of Dairy Science, and dairy editor, Capper Farm Press, Lincoln, Nebr.

Mr. Chairman, ladies, and gentlemen: The subject which the chairman has assigned to me is one that I fear may not be of maximum interest to you extension workers, and I see many of you in the audience. However, I was assured by the program committee that from their correspondence with people of Europe and other countries there was a great deal of confusion regarding our various types of publications, and I was asked to take a few minutes to explain, as well as I could, the nature of our various publications.

"Why are Americans so fond of printing bulletins and circulars of every description instead of utilizing the world's accepted scientific journals—the regular channels—for the dissemination of research information?" is a question often asked by scientific workers from abroad.

The writer of this paper holds no brief for scientific workers in this country, but will venture the suggestion that if we familiarize ourselves with the historical aspect of the early experiment stations and the provisions of the Hatch Act, under which agricultural investigation in this country had its inception, we will see why research workers have fallen into the habit of depending so largely upon their own station bulletins instead of upon scientific journals as a means of acquainting their fellow workers and the general public with their progress of work.

THE HATCH ACT.

The Hatch Act, to which I refer, has a provision which reads as follows:

> That in order to assist in acquiring and diffusing among the people of the United States useful and practical information on subjects connected with agriculture, and to promote scientific investigation of agricultural science, experiment stations shall be established and bulletins or reports of progress shall be published as often as once in three months, and these shall be distributed to farmers and newspapers.

This organic act under which all United States experiment stations function is not very specific either as to what shall be published, how it shall be written, the style, the shape, or the size of publications. In fact, all of this detail is left to the discretion of the director of the experiment station and his staff of workers in each State.

When we remember that we are a nation made up of 48 different States, each one of which is operating to a very large extent independently of the others, and under its own laws and often with its own ideas as to how results of its experiment station can best be disseminated among its own citizens, we can account for the striking variation in type of publication of the many bulletins issued by the experiment stations in this country. Most American scientists understand these variations, though it must be admitted that there is as yet considerable confusion among our own laity, as well as among those unacquainted with our customs, concerning our apparent lack of uniformity regarding scientific publications.

Then again, agricultural college workers in the United States do not, as a rule, consider it a mistake to frame or write their bulletins so as to make them intelligible to the general public, although it frequently means carrying results far enough along so that they can be interpreted in terms of general practice as well as making them a contribution to science.

Many station workers feel that such effort will make clear and more applicable the finding of these investigations and that by means of these popular publications they are keeping their departments and their institutions before the public, even though a great deal of time is given to long, tedious research problems whose solution may take years of study. In fact, with American experiment stations supported, as they are, largely by popular taxation, many station directors feel that it is quite essential to keep in touch with their constituency by means of bulletin material in order to maintain popular interest and to get the support and adequate appropiations which they must have to carry on their work.

This struggle on the part of individual stations for popular support, coupled with a too literal interpretation of the Hatch Act, has in the past led to the almost exclusive use of the bulletin form for the publishing of scientific data. Now, however, much of this short-sightedness of the station director in refusing permission to publish in scientific journals is being overcome.

VARIATION IN CLASSIFICATION.

Full authority having been vested in the director and staff of each experiment station in the several States to publish results of their findings in such bulletins as considered by them most suitable to their constituencies naturally resulted in a lack of uniformity.

For instance, practically all the stations are issuing technical bulletins covering most of the research work done at the station. These are sent only to scientific workers at home and abroad. This bulletin is variously known as "technical bulletin," "research bulletin," "investigational bulletin," and "memoirs," a nomenclature not only confusing, but one which it would seem might easily be standardized. Similarly, the publication used for the dissemination of popular information is known as "extension bulletin," "extension circular," "reading course circular," or "extension leaflet."

The number and variation in type of these bulletins have grown to such extent that our stations and agricultural colleges are already making concerted efforts toward standardization of all their publications. With but few exceptions, we find that our land-grant colleges now have agreed upon three types of publications:

(1) *Research bulletins.*—These are technical in nature, cover only work done at the station, and are sent only to scientific workers at home and abroad.

(2) *Station bulletins*, which might appropriately be called "popular bulletins." This type of bulletin generally gives results of research work, with or without technical data upon which the conclusions are based. It may be a review of a research bulletin or it may be an original publication.

(3) *Extension bulletins*, which are generally published by the extension department of the agricultural colleges, but sometimes by the experiment stations, as "experiment station circulars." These are generally limited to a popular but accurate discussion of some problem important to the State's agricultural interests, boys' and girls' club work, or household conveniences. They need not be based on strictly scientific work.

While most of the publications issued by the State experiment stations fall under this classification, some of the States, in an effort to popularize their work and to reach those not in the habit of requesting bulletins, are putting out what is termed "poster bulletins" which, as the name implies, are used for posting purposes. This type of bulletin carries considerable information and tells the reader where he can get additional information on the particular subject under discussion.

UNITED STATES DEPARTMENT OF AGRICULTURE PUBLICATIONS.

The United States Department of Agriculture has a designation all its own. Briefly stated, their publications are listed as farmers' bulletins, which contain the results of the department's work based on scientific knowledge and written in such form as to be of most assistance to the farmers. The department also publishes circulars which are similar to the farmers' bulletins, but differ in that they are not written especially for farmers and are frequently brief reports of scientific research.

SCIENTIFIC JOURNALS.

The dairy research men of the Department of Agriculture now utilize the Journal of Dairy Science and the Journal of Agricultural Research to a very considerable extent for the publication of the reports of their work.

The Journal of Dairy Science is published by the American Dairy Science Association and is its official organ. Its columns are open for the publication of dairy research data. It also publishes proceedings of the association meetings and abstracts of such general scientific work as will be of interest to dairy workers.

The Journal of Agricultural Research is a weekly scientific journal, and is published jointly by the Association of Land-grant Colleges and the United States Department of Agriculture, and is the official organ for land-grant college workers.

In addition to the above-named journals, much use is made by dairy workers of such publications as the Journal of Bacteriology and the many chemical publications for articles of a special bacteriological or chemical nature.

TRADE PAPERS.

Much dairy information of a semipopular nature is sent direct to the trade or professional dairy papers whose editors aim whenever possible to publish quite fully such data as are of direct interest to their readers. Research work pertaining to animal production is generally sent and published quite fully in such dairy husbandry papers as Hoard's Dairyman of Fort Atkinson, Wis., and the Dairy Farmer, published by the Meredith Publishing Co. of Des Moines, Iowa. The Jersey Bulletin, the Holstein-Friesian World, the Guernsey Journal, and the Ayrshire Digest, all publish information of particular interest to breeders of purebred dairy cattle. Besides these special channels, much dairy information is sent out through such of the regular farm press papers as are devoting much attention to dairying.

If the data are of peculiar interest to manufacturers of dairy products, such as butter, cheese, ice cream, fluid milk, and other milk products, it will find an outlet in such papers as the New York Creamery and Produce Review, of New York; the Chicago Produce, of Chicago, Ill.; the Butter, Cheese, and Egg Journal, of Milwaukee, Wis.; the Creamery and Milk Plant Monthly, of Chicago; the Ice Cream Trade Journal, of New York; and others of similar nature.

TREND TOWARDS SCIENTIFIC JOURNALS.

Briefly, this sums up the main channels through which dairy information is being disseminated in this country by publications. At present the tendency in most of our best stations is toward the use of the standard research journals as vehicles for scientific papers and for reports of progress, publication in them being simultaneous with, or even previous to, the appearance of the material in bulletin form.

In fact, this trend toward the use of scientific journals, such as the Journal of Dairy Science, the Journal of Agricultural Research, the Journal of Bacteriology, the Chemical Journal, and the like, is so pronounced that the author has no hesitancy in venturing the suggestion that in the near future all our best dairy research work will be available in scientific journals; and that the foreign worker interested in dairy research will not have to concern himself very seriously with our semipopular bulletins and circulars, which, after all, are largely intended for general home distribution.

EXHIBIT.

In order that you may have opportunity to visualize what I have attempted to explain in the few minutes allotted to this subject, I have collected and brought here copies of the various types of bulletins, circulars, and posters published by our leading experiment stations. In this exhibit you will also find samples of scientific and trade journals mentioned in this paper.

I have in this collection samples of these various journals that I have mentioned, and I have various types of these bulletins. Some of them are the technical bulletins. Some are called research bulletins, and I have samples of the various popular bulletins and of the various experiment station circulars and of the various extension circulars.

I think that from what I have said and from what you can see of this type of publication you will be able to form a better idea of the type of publications available to the American reader. I think the people from abroad might be interested in the effort that some of our colleges have made to reach the type of people who do not request bulletins. There is a type of the poster bulletin [exhibiting] which is published by some of the colleges. This happens to be published by the University of Missouri.

There is a type of poster published by the extension service of the Iowa Stage College. It shows the importance of purebred sires.

There is one published in North Dakota.

Here is a poster bulletin published by the College of Agriculture Extension Service of Nebraska. It attempts to tell in a nutshell the different diseases of swine.

Here is a poster bulletin calculated to impress people with the need of more milk for children. This is published by the extension service of Wisconsin.

There is another Missouri bulletin intended to stress the importance of using better bulls.

I feel like apologizing for taking the time of the extension workers on this subject, but the committee felt that there was a need for giving a little added explanation to the people from abroad on this subject.

Chairman HATCH. I will ask the Secretary to place this material, which Mr. Frandsen has shown, on the table in front where you will all have an opportunity of examining it after the close of the session. I assume, Professor Frandsen, that your duties elsewhere will not permit you to take part in any general discussion at this moment?

Mr. FRANDSEN. If there is a question or two I would be glad to answer them.

Chairman HATCH. Then, let us have any questions quickly.

Prof. R. C. FISHER (Connecticut Agricultural College). I would like to ask Professor Frandsen if he believes it would be a better policy for the experiment stations to follow more the suggestion which he made of distributing the technical knowledge through the means of technical papers rather than in bulletin form? Does he think that would reach more people who are interested than in the form of bulletins? It is a question that came up at our experiment station staff meeting the other day.

Prof. FRANDSEN. I don't know that my opinion would be worth very much on that, Professor Fisher. I have no objections at all to the stations publishing all this information as soon as possible, but I do think that since they are anxious to reach at the earliest moment all their associates in the same line of work, it would be desirable that that information be made available at once through their scientific journals.

For instance, workers in this country, as well as abroad, are all readers of their scientific journals, and they look for information along their lines. To make it available in any other way frequently delays the coming of that information into the hands of our associates.

That would be my reason for feeling that by all means all our station workers ought to work around to the point where their information is made available through the columns of the scientific journals.

There is another reason for that. I have been connected with an experiment station for a number of years, and I happen to know—and I presume that is the general condition—that frequently money is not available for the publishing of results when they are out. That is a very good reason why this information should be released through the scientific journals.

I think our workers should also feel that it does not bother the college to publish a bulletin. Our best experiment station directors now, I think, are readily consenting to publishing in the journals, with the understanding that the material will be published in bulletin form as soon as conditions permit.

I think that you, as workers in the various stations, could carry that message to your various station councils, Professor Fisher, and see if you could not get that policy made more universal in all our stations.

Chairman HATCH. Are there any other questions? If not, we will proceed with the regular order.

We have the very great pleasure of announcing to you that we have with us this afternoon a gentleman who has traveled halfway around the world to be with us. Unfortunately, this information did not reach the committee in time to have his name published in the printed program, but I now have the great pleasure of presenting to you Prof. Taraknath Das, representing Seva Sangha and the Central Cow Protection Society of India. Professor Das. [Applause.]

Mr. DAS. Before I read my paper, Mr. Chairman and ladies and gentlemen, I wish to express my thanks to the World's Dairy Congress on behalf of India for this privilege.

DEVELOPMENT OF THE DAIRY INDUSTRY IN INDIA.

TARAKNATH DAS, representing Seva Sangha and Central Cow Protection Society, India.

It is my great privilege to represent various cow-protection societies of India in this International Dairy Congress. So at the outset I must say a few words regarding the Hindu attitude toward cow protection. It is generally supposed that the Hindus, because of their religious superstitions, worship "the sacred bull." But the real ethical and sociological background of this attitude of veneration, verging to worship, toward "cow" is very simple. The Aryan ancestors of the Hindus were pastoral people and to them cows were very valuable, and in the ancient scriptures like the Mahabharata we find the expression "go-dhan," the literal translation of which is cow wealth. The social utility of cow in every phase of human existence has been so great in Hindu life that the cow is regarded as one of the seven mothers of an individual. The great Chanakya says:

> One's own mother, wife of the spiritual guide, wife of a Brahmin, the wife of the King, cow, nurse, and the Mother Earth are really seven mothers of every individual.

Liberality and gratitude are the two important factors in Hindu ethical code, and the spirit of veneration toward cows is nothing but manifestation of gratitude. When a person is born he or she becomes indebted to cows for the milk that nourishes life; by the labor of cows the ground is tilled to produce food which sustains the body; when sick and about to pass away from this human existence man uses milk as the best diet.

Bones of cows as well as cow dung are used as fertilizers, and thus the cow is helpful to Indian society more than we can appreciate in words. and the cow is respected, and Hindus do not want to kill cows for food when they can live upon other food; other kinds of animal food if necessary.

CATTLE IN INDIA.

India has the largest number of cattle in any country, although that is not so when it is taken per capita into consideration. According to the census report of 1919–20, the total livestock enumeration of India is 196,000,000, of which 146,000,000 are bovine (bulls and bullocks, cows, buffalos, calves, etc.), 46,000,000 ovine (sheep and goats), 4,000,000 others (includes horses, ponies, mules, donkeys, and camels).

According to the 1919–20 cattle census, the number of cattle per 100 acres (sworn acreage) ranges from 101 in Bengal to 30 in Bombay; while the number per 100 of population varies from 86 in the Manpur Pargana to 33 in Delhi. The average for British India as a whole, is 66 cattle per 100 acres of sworn area and 61 cattle for 100 of the population. Very considerable numbers of these cattle are maintained at a loss, owing to their unfitness either for labor or for supplying milk. But the problem can not be tackled upon the same lines as would be possible in western countries, for the reason that veneration for the cow is universal throughout the large portion of the population of India. It is thus impossible to treat the question as one of pure economics; if only because the popular sentiment will not agree to the elimination of the unfit and wasteful members of the cattle population. The *amelioration of the position depends first upon improving the breed of cattle, and secondly, upon its preservation both from disease and from famine.* * * * *There can be little doubt that a considerable portion of India's cattle population is underfed, and that one way of increasing the percentage of useful individuals is to popularize those forms of fodder which at the present moment are neglected because unknown.* The preservation of Indian cattle from contagious diseases presents certain difficulties peculiar to the country. It is not necessary merely to fight against the natural sources of infection, which are numerous, but also against ignorance, old established customs, and prejudices on the part of the people themselves. Cattle owners, when disease is prevalent in a village, often remove their cattle to another locality; and it will be a long time before they can be made to realize that such movements of cattle are the means of spreading disease. Until the cattle owners themselves understand the importance of early information and segregation in the suppression of these periodical outbreaks, disease must remain a source of loss to them and danger to the agricultural interests in general. (Pp. 163–165, "Statement exhibiting the moral and material progress and condition of India during the year 1921.")

DETERIORATION OF CATTLE.

Underfeeding, famine, and disease are destroying Indian cattle. There is marked deterioration of Indian cattle from other causes.

Owing to the encroachment of cultivation in the grazing areas, well-bred cattle are becoming scarce, and some of the breeds are threatened with extinction. Efforts to improve the quality of cattle in nonbreeding districts by selected bulls have hitherto been frustrated by the promiscuous breeding which goes on in the villages. (India Yearbook, (1922), p. 313.)

BACKWARD STATE OF CATTLE BREEDING.

Cattle-breeding, which is in a very backward state in India, has received great attention in all Provinces of India, both to improve breeds and to induce the people to devote more care to the problem so closely wrapped up with their welfare. In the latter direction success has been limited, but in the former most valuable results have been obtained. A typical example is the case of the special breeding of milk cattle at the Government of India farm at Pusa and at other farms associated with it in this work. In one herd of country cattle strict selection for milk yield has rendered possible the elimination from the herd of all cows giving less than 3,500 pounds of milk in the lactation period of 10 months from calving. In another herd, records concerning hundreds of animals during 10 years have shown that a cross of well-bred Ayrshire bull with an Indian cow will double the milk yield of the Indian breed. One cow of this kind at Pusa gave 10,000 pounds of milk in one year. (India Yearbook (1922), p. 319.)

These are mere experiments not yet popularized.

In the State of Mysore a great deal of experimental work in cattle breeding is being carried on, and the result is satisfactory. But the work is still limited in the field of mere experiments and research.

AMERICAN GENEROSITY IN AGRICULTURAL RESEARCH IN INDIA.

India is indebted to America for the interest of American citizens, some American agricultural missionaries like Mr. Higginbottam, for taking practical steps for spreading agricultural education. As Mr. Lubin, an American citizen, was the originator of the International Institute of Agriculture at Rome, so Mr. Phipps, an American citizen, had a great deal to do with inducing the British Government in India to undertake agricultural research work in India.

A great impetus was given to the development of the agricultural department by the decision of the Government of India in 1905 to set apart 20 lakhs (a little over $600,000) a year for the development of agricultural experiment, research demonstration, and instruction. The ultimate aim, as then expressed, was the establishment of an experimental farm in each large tract of country in which the agricultural conditions are approximately homogeneous, to be supplemented by numerous small demonstration farms; the creation of an agricultural college teaching up to a three-year course in each of the larger Provinces; and the provision of an expert staff in connection with these colleges for the purpose of research as well as education—the eventual cost, it was recognized, would largely exceed 20 lakhs a year. The Pusa Research Institute and College alone has cost £150,000, including the equipment. *A part of the cost was met from the sum of £30,000 placed at Lord Curzon's disposal by Mr. Phipps, an American visitor to India.* This example of munificence has recently been followed by Sir Sasson J. David, who placed the sum of £53,300 at the disposal of the Government of Bombay for the establishment of vernacular agricultural schools and the improvement of agricultural methods in commemoration of the visit of their Imperial Majesties to India. (Pp. 313–315, India Yearbook, 1922.)

INADEQUACY OF AGRICULTURAL EDUCATIONAL FACILITIES IN INDIA.

The facilities for agricultural education for over 315,000,000 of people in India, 90 per cent of whom live in villages and 85 per cent depend upon agriculture, have been summarized in the following statement:

Higher branches of agricultural research are carried on in the Agricultural Research Institute at Pusa. There are in addition agricultural colleges at Poona, Llyalpur, Cawnpore, Coimbatore, Nagpur, and Sabour, and it is proposed shortly to open similar institutions at Dacca and Mandalay. The agricultural college at Poona, which is affiliated with the Bombay University, continues to maintain its popularity, the number of students on the roll being now more than 200. One much appreciated feature of the activities of the college is a short course in agriculture which is given to farmers' sons who are not qualified to take the university course. A somewhat similar plan is employed in the agricultural college at Llyalpur, which provides a degree course, subject to university rules and regulations, and a shorter certificate course. But in addition to these there is also a vernacular course dealing with practical agriculture. In secondary education in agriculture almost every Province continues to show progress. In Bengal, experiments in connection with agricultural instruction are being made in two schools. In the United Provinces the agricultural school established at Bundelshahr will be organized on lines similar to those of the short two-year course of Cawnpore Agricultural College. In the Central Provinces the syllabus for the two agricultural middle schools was revised during the year, but in this locality there does not seem to be any applicable demand for the instruction of the type of training which they provide.

Bombay continues to maintain its lead over the other Provinces of India in the field of secondary as well as higher agricultural education. During the year there were six agricultural schools at work, which seem to be very successful. But this type of training has yet to commend itself to the people for whom it is primarily planned. In the Punjab the less costly plan of providing practical training in agriculture for boys in certain vernacular middle schools alongside their general training is being tried. Generally speaking, throughout India, the demand for school and college instruction in agriculture is surprisingly small, when the prominence which this pursuit plays in the life of the country is considered. (Progress and Prosperity of India, 1921, pp. 249–250.)

It is needless to add that in order to raise India to an agricultural efficiency of the type of the United States, it would be necessary to have at least 100 times more efforts than what the Government and private citizens of India are exerting to-day.

DAIRYING INDUSTRY IN INDIA.

Though little noticed, dairying forms a very large indigenous industry throughout India. The best-known products are native butter (ghee) and cheese (dadhi). During recent years a considerable trade in tinned butter has sprung up in Gujarat (Bombay Presidency). *While pure ghee and milk can be procured in the villages, in towns dairy products can scarcely be bought unadulterated.* (P. 313, India Yearbook, 1922.)

In this connection it is safe to assert that modern dairying is practically unknown to the Indian masses, and this ignorance of the people is costing the nation very considerably, not only in the form of material wealth, but in the form of human lives. Health of children is very much dependent upon the use of pure milk. Thus problems of pure milk, dairy industry, and infant mortality are all closely connected.

INFANT MORTALITY IN INDIA.

Among the most pressing problems of India's health is that presented by the appalling infant mortality. It has been calculated that every year no fewer than 2,000,000 babies die, while many others survive, only to grow weak and feeble from unhygienic surroundings during infancy. (Progress and Prosperity of India, 1921, p. 217.)

This infant mortality and the general deterioration of the national health and increase of death rate, which is about 40 per thousand, and the shortening of the span of life in India, which is about 25 years, is not only a problem of national sanitation, but a problem in dietetics and at the same time the question of the poverty of the nation as a whole. The remedy lies, among other things, in proper kind of education of the people—masses.

POVERTY OF THE INDIAN MASSES.

Regarding the poverty of the masses of India, it has been remarked in the following way:

But the symptoms of increasing prosperity such as has been described can not blind the observer to the poverty which besets masses of Indian population—poverty of a kind which finds no parallel in the more exigent because less tropical climate of Europe. * * * As time goes on, it may be hoped that the increased development of India's resources will gradually create a per capita figure of wealth which will suffice for her needs as a nation. The industrial regeneration of 240,000,000 of people (really 315,000,000), the majority of whom are poor and helpless beyond western conception, is not a matter which can be accomplished in a few years. (Progress and Prosperity of India, 1920, pp. 135, 136.)

RISE OF PRICE AND INCREASING POVERTY OF THE MASSES OF INDIA.

The precise effect of such a rise in prices as that which has been a universal consequence of the World War upon the condition of the rural population of India, that is to say, upon the 90 per cent of the Indians, is a matter upon which differences of opinion have been manifest. * * * But the general effect on the village population of a rise in prices without a corresponding rise in wages is apparently disastrous; and the annual deficit of expenses over earnings in the families belonging to a given village increases enormously. *On the whole it may be said that a rise in prices tends to emphasize economic differences throughout the rural population of India, those who are well-to-do becoming more well-to-do and those who are poor becoming poorer.* Since the average margin of subsistence is very small, the tendency of wages to lag behind prices has been responsible for a good deal of distress. (Progress and Prosperity of India, 1920, pp. 133–134.)

Because of this awful, abject poverty of the Indian masses, it can not be expected that they would take the initative to improve the agricultural condition of the nation through improved methods. In fact, the educational condition of the masses of India is such that it stands in the way of making great progress in scientific agriculture. The Government and the well-to-do of India are fully dependent upon the labor of the peasants, yet it is manifest that they do not pay any special and necessary attention to the well-being of the masses.

THE EDUCATIONAL POSITION OF INDIA.

* * * In British India there are only 8.2 millions in all educational institutions put together. That is to say, only 3.36 per cent of the population is under instruction, this figure being made up of 5.5 per cent of the males and 1.2 per cent of the females. * * * About 2.5 per cent of the population is enrolled in primary schools, and less than 3 per cent is undergoing elementary education of any kind. In the secondary schools, on the other hand, 0.5 per cent of the population is under instruction, an abnormal figure, comparing very remarkably with the 0.6 per cent which has been estimated as the figure in Great Britain. Considering the female population of the secondary schools is very small, it would seem that if the male population alone be reckoned, no less than 0.9 per cent is found in the secondary schools—a proportion far greater than the corresponding figure for England and Wales, and approximately equal to that of Germany before the war. In university education the percentage of Indian population undergoing instruction is no less than 0.27 per cent, which, considering that here again the female population of India may be almost eliminated, compares remarkably well with 0.554 of England and Wales. * * * An examination of the proportion of the college-going population to the total population of a single tract like Bengal indicates that with a population approximately that of the United Kingdom the *proportion of the educated classes who are taking full-time university courses is in such tracts almost 10 times as great as in England.* (Statement Exhibit, Moral and Material Progress and Condition of India during the year 1920 (printed by order of the House of Commons), p. 163.)

ILLITERACY IN INDIA.

The population in British India is, according to the census report of 1920, 244,020,100, of which 124,747,805 are males and 119,272,295 are females. (The Native States of India have over 70,000,000.)

In the year 1919–20 the total expenditure on education amounted to Rs. 148,896,960, of which Rs. 84,463,472 came from public funds. In spite of this marked advance, there is much leeway to make up, as in the last census report the literate population of India was only 59 per 1,000 (186 males and females, 10 per 1,000). (India Yearbook (1922), p. 449.)

DEFECTS OF INDIAN EDUCATIONAL SYSTEM.

There are thus good grounds for the criticism so frequently directed against Indian education in the press—that its structure is top heavy. The lower classes are largely illiterate, while the middle classes, who constitute the bulk of the intelligentsia, are, in point of numbers at least, educated to a pitch equal to that of countries whose social and economic conditions are far more highly developed. The reasons for this peculiar situation must be sought in history; but in the main they resolve themselves into the statement that the total educational funds being small, have come to be concentrated upon meeting the demand of those who perceive the benefits of education rather than upon cultivating a desire for education where it does not at present exist. As might be expected from the abnormal distribution of education among the population of India, the form which it has actually assumed reveals corresponding defects. Since it has been framed primarily with a view to meeting the demands of the intelligentsia, it is of a predominantly literary type. Only 0.05 per cent of the population is undergoing instruction in professional colleges and other institutions which provide technical training, as against 3 per cent which is found in nontechnical institutions. Up to the present time the courses which have been most popular among middle-class intelligentsia have been literary, because they lead to Government employment, and are preliminary to the pursuit of legal profession. Fortunately, there are indications that public opinion is becoming alive to the necessity of encouraging technical education, and it is hoped that in the future there will be much needed expansion in this direction. From the point of view of the educational expert there are three principal defects which determine the peculiar limitations of the Indian system.

In the first place, properly trained teachers are hard to find. Out of the total of 204,000 teachers of vernacular in India, only 70,000 are trained at the end of the year 1919–20. In the Anglo vernacular schools, out of a total of 100,000 Anglo vernacular teachers only 35,000 were trained, and only 11,000 possessed a degree. It is this condition of affairs which has produced a second defect in Indian education, namely, that there is little incentive for men of the right sort to enter the teaching profession. Teachers are seriously handicapped by small salaries and less estimation, with the result that with honorable exceptions the profession is not popular among men of high capacity, and there are often obstacles preventing that enthusiasm which more favorable circumstances might evoke. In the third place, Indian education has hitherto been dominated by an examination system. Fortunately there is reason to hope that this particular difficulty, which has exercised a paralyzing blight upon true educational progress for many years, may before long be remedied as a result of the salutary recommendations of the Calcutta University Commission. (Statement Exhibit, Moral and Material Progress and Condition of India During the Year 1920 (printed by order of the House of Commons), pp. 164–166.)

DIFFERENTIATION IN EXPENDITURE ON THE BASIS OF SPECIAL PREFERENCE TO THE EUROPEANS.

At the meeting of the Bengal Legislative Council, Dr. Pramathanath Banerjee said that Rs. 1,066,000, the cost of educating the Europeans and Anglo-Indians, worked out at *slightly less than 10 per cent* of the total cost of educating the rest of the people of Bengal. What was the proportion which these communities bore to the non-European and non-Anglo-Indian population of the Province? Roughly speaking, the number of Anglo-Indians and Europeans in Bengal was 45,000. The ratio was thus 1 to 1,000. If they took the expenditure for education per head of the population, they would find that *a European or Anglo-Indian cost the State roughly one hundred times as much as a native of the Province.* * * * The plain fact is " European " education is supported in this lavish manner because Europeans are the ruling race and the Anglo-Indians are their blood relations. * * * It is entirely unjust that any community should have a preferential claim on revenues contributed by all—particularly when that community considers itself quite different from and far superior to the children of the soil. (The Modern Review, April, 1923, p. 534.)

CONCLUSION.

Thus the problem of development of dairy industry in India involves a greater problem of bringing about a better condition of 90 per cent of the people of the land through better agricultural education for the masses, which would increase productivity in the field of agriculture and dairy industry as well.

This is probably one of the greatest tasks that is facing the people of India. Without attempting to advise what the Government of India should do, I feel that the landlords of India, who are growing fat at the expense of the masses, should do all that is possible to establish more agricultural institutions in India where peasants may be given the chance of acquiring knowledge of practical scientific agriculture, including establishment of model dairies as well as breeding cattle. The efforts of Dr. Rabindranath Tagore to have an agricultural department in his International University, Visva Bharati, not merely to carry on agricultural research but to extend the work in village reconstruction, should be whole-heartedly supported and such an institution should be established in every Province of India. In this connection, it may be appropriate to point out that American and other manufacturers of agricultural, and particularly dairy machinery, would do a great good to themselves and the people of India if they can establish one or two model dairies in India to train the Indian youth of education to handle the machinery and master the dairy industry in such a way that they would fully realize that it would be profitable for them and for the nation to enter into the dairy business. This may seem to be a costly proposition. However, in the final analysis of the cost involved in such an experiment, we find that it would be cheaper than the advertising campaign that would be necessary to open up the market of India and also train proper and interested salesmen for the great market of 300,000,000 of people.

Under the present backward condition of the agricultural people of India, mere agricultural research on milk technology alone will not solve the problem. India will have to adopt the method of "traveling teachers system" of the State of Iowa and other American States so that these teachers would work as pioneers to create all necessary conditions for the improvement of cattle, need of pure milk, introduction of modern means of agriculture, including the dairy industry. I have already mentioned that through the generosity of an American the work of agricultural research has received its impetus, and let us hope there will be measures taken by the dairymen and others of America, and Indians themselves, so that there will be greater impetus for Indian youth to master American methods of dairying and introduce them in all parts of India.

In conclusion I would like to emphasize that if proper dairy experimental stations could be established and popular demonstration work could be carried on in India, the peasants of India could be interested to undertake dairying extensively through peasants' cooperative societies and loan banks, which in recent years have come into existence by thousands in every part of India.

Chairman HATCH. I am sure we are all very appreciative that Mr. Das could be with us and present this most thorough and comprehensive outline of the dairy and agricultural problems in India.

I am certain that you want to ask some questions. We will take now about three minutes for the discussion of this paper before we return to the numbers that were placed at the foot of the calendar.

Mr. JOHN PHILLIPS (United Dairies (Ltd.), London, England). I would like to inquire about the rate of infant mortality in India.

Professor DAS. There is a general misconception that the birth rate in India is very much larger than that of the death rate and thus the population is increasing in leaps and bounds. But the actual fact is that the population of India is not increasing at the same rate as it is increasing in England or some other European countries. Taking the latest available statistics of the year 1919 into consideration, the India Yearbook of 1922 makes the following comments regarding the birth and death rates of India:

> The population of the areas in which births and deaths were registered in 1919 was 238,482,205; 7,212,450 births and 8,554,178 deaths were registered; the rate per mille being 29.54 and 35.87 as compared with an average of 37.34 and 36.84, respectively, for the previous five years.

This discloses a very significant fact that for the year 1919 the death rate was larger than the birth rate of over 6 per mille and for the previous five years the birth rate was larger than death rate only by 0.5 per mille. If this situation continues, then, the population will be stationary like France. What is necessary for India is that the birth rate and death rate both should come down to the standard of England or France. From an economic point of view and from the standpoint of national health, large birth rate with large death rate is a great loss to a nation. This change can only come to India through higher standards of living brought about by better economic and educational conditions. I have not the statistics exactly, but I can say that, of all the cities of the world, Bombay leads in infant mortality.

Chairman HATCH. Are there any other questions?

Mr. G. I. PRICE (London, England). What proportion of the revenue of the country is spent on agriculture?

Professor DAS. It is hard for me to answer that exactly. However, this year 51 per cent goes for the military; last year it was 61 per cent. I can very safely say that less than 1 per cent of the revenue goes for the spreading of education as a whole; a very small part of that goes for agricultural education. That is the situation in India to-day.

Once I made a computation and I discovered that the amount of money from the revenue from opium alone is not utilized for education of the masses. Education is the most neglected thing in India, so much so that 6 per cent is the literacy in India.

Chairman HATCH. Are there any other questions?

If there is no further discussion, we will turn now to the numbers placed at the foot of the list. If there is no objection, I shall take it as the sense of this session that we should first call upon those who are present in person for the presentation of the subjects placed at the foot of the list, and then, if time permits, ask those who are representing the authors to present those topics.

Do I hear any objection to that procedure? If not, we will consider that unanimous consent is given.

I am now pleased to call upon Mr. J. F. Blackshaw, dairy commissioner, Ministry of Agriculture and Fisheries, England, who will speak upon the subject, "Methods adopted in England and Wales to convey education and the principles of cooperation to the farmer." Mr. Blackshaw. [Applause.]

METHODS ADOPTED IN ENGLAND AND WALES TO CONVEY DAIRY EDUCATION AND THE PRINCIPLES OF COOPERATION TO THE FARMER.

J. F. BLACKSHAW, O. B. E., dairy commissioner, Ministry of Agriculture and Fisheries, London.

The purpose of this paper is to convey an outline of the general scheme of instruction in dairying which is now being followed in England and Wales.

This general scheme, as well as its aims and objects, will be better understood if it is prefaced by a brief description of the conditions to which it is applied.

Dairy farming as a branch of English and Welsh agriculture is to-day much more widely distributed and more generally followed than it ever was before. The last 60 years have witnessed many changes in the systems of farming, but it may be said without fear of contradiction that the greatest change has been in the direction of dairy husbandry, particularly in the production of milk for human consumption. So recently, as to be within the memory of many of our oldest inhabitants, the milk required by our populous centers was produced either by herds kept within the towns or on farms situated on the outskirts. At that time our chief dairy counties, such as Cheshire, Lancashire, Derbyshire, Staffordshire, and Somerset, marketed their milk in the form of cheese or butter; indeed, there were no other outlets than these except the raising of young stock.

The development of railway transport and the growth of urban populations have been the chief causes of the changes which have taken place as well as of the more general development of dairy farming in almost every county. It is probably correct to say that quite 50 per cent of the farms now devoted to milk production were, until recent years, otherwise employed.

The older, or what may for convenience be called the original dairy farms, are in almost all cases provided with structural conveniences for the manufacture of dairy produce, and are farmed by persons to whom the art of manufacturing milk products has been handed down through generations, but in the case of most of those farms which have been brought into the industry in recent years there exists neither the structural convenience nor the necessary technical knowledge of dairy manufactures to enable the occupiers to do otherwise than place their milk upon the market.

The counties of England and Wales viewed individually will be found to show wide variation in regard to the intensity of the cow keeping practiced therein. This variation is conveniently illustrated in the following table, which compares the respective cow population with the cultivated acreage.

	Acres of cultivated land per 1 cow.		Acres of cultivated land per 1 cow.
1 county	3	3 counties	14
1 county	4	4 counties	16
1 county	5	2 counties	17
5 counties	6	1 county	19
5 counties	7	3 counties	20
6 counties	8	1 county	21
5 counties	9	2 counties	22
3 counties	10	1 county	23
7 counties	11	2 counties	24
1 county	12	3 counties	29
4 counties	13	1 county	35

The more intensive milk producing counties are still those on the west side, due to the fact that soil conditions coupled with a more consistent rainfall support the best pasturage. The intensity of the west as compared with other districts is not, however, so pronounced to-day as it was a few years ago, as milk production is elsewhere gradually replacing other systems of husbandry.

There are a considerable number of country milk depots which function as centers for the collection and treatment of milk for transport to the towns, and for the manufacture of milk products. Most of these depots are proprietary, but many are owned and managed by cooperative societies of farmers. The country is, however, by no means covered with these depots; indeed, the bulk of the produce is still manufactured in farmhouse dairies, and the bulk of the milk sold is still dispatched direct to the centers of consumption by the producer.

It is computed that the estimated production of milk in Great Britain in 1921 (excluding milk used for calf rearing) was 1,220,000,000 gallons, of which 84 per cent was produced in England and 16 per cent in Scotland, and that this milk was disposed of as follows:

	Gallons.
Consumed as liquid milk	600,000,000
Manufactured into butter	394,000,000
Manufactured into cheese	100,000,000
Manufactured into condensed milk	35,000,000
Used for cream and miscellaneous manufacturing purposes	61,000,000
Allowances for wastage, spilling, etc	30,000,000
Total	1,220,000,000

Such, then, is the general setting of the practical conditions to which our schemes for advice and instruction in dairying are applied, and it only remains, before proceeding to consider the broad outline of the educational scheme in operation, to refer to the paper on "The status of dairy education in England and Wales," by Mr. V. E. Wilkins, B. Sc., in which it is pointed out that the administration of instruction in dairying rests with the county education authorities, of whom there are 61 in England and Wales, and (for most of the higher types) with governing bodies of college and agricultural departments of some of our universities. The Ministry of Agriculture, in virtue of its grants made in aid of the various forms of instruction, is in a position, however, to suggest schemes and to exercise a controlling influence.

DAIRY EDUCATION SCHEME.

Following the passing of the local taxation (customs and excise) act of 1890, which placed at the disposal of local education authorities certain funds (derived from the taxation of spirituous liquors) to be devoted to the provision of technical instruction, education in dairy technique was, in the rural areas, one of the first subjects taken up. Most counties started by providing practical demonstrations of the most approved method of butter making. This later developed into the provision of traveling dairy schools, with, in addition, a certain number of fixed dairy schools, and so the work has gone on. These earlier schemes have, quite naturally, been remodeled from time to time as accumulated experience has shown the need. Their extended application has also followed, as fast as has been made possible by the increased provision of State aid.

In framing the general scheme now working, certain central objects have always been kept in mind, and these given in the order of their importance, may be briefly indicated as follows:

1. It is the people who are actually engaged in the industry that count most. They are busy people and are usually occupied for seven days in the week. Therefore, take the instruction to them and do not expect them in the first instance to come to you.

2. Every person on the farm who handles milk should possess an intelligent appreciation of the things that matter, otherwise he can not be expected to do the right thing at the right time. Therefore, the employee as well as the employer should be instructed.

3. Traveling schools have their limitations in regard to scope. They can only proceed so far in the scale of education. Therefore, encouragement should be given to the best students to proceed from them to the fixed county dairy school (or farm institute), and, if good enough, from the latter school to the still higher course at the dairy college, so that these bright students may later help in advancing the industry, either as professional teachers or, by the practical example of their better managed farms, becoming in effect "demonstrators."

4. Instruction should embrace economic production as well as improved quality of produce.

5. For the safety and general well-being of the industry every producer should be able, if it should be advisable to do so, to convert his milk into products, either on his own farm or in a dairy jointly conducted with his neighboring dairy farmers. This necessitates the provision of education in the true principles of cooperation as well as in the technique of the manufacture of milk products.

The complete scheme of educational assistance provided for dairy farmers is composed of several subschemes, of which the following are the main:

I. Pioneer lectures consisting of one to six meetings at centers convenient to country audiences.

II. Exhibits, demonstrations, and lectures at agricultural shows.

III. Improvement of the smaller dairy herds by the formation of bull clubs.

IV. Improvement of milk yields by the formation of milk recording societies.

V. Advisory work in feeding and management of dairy stock.

VI. Courses of instruction in clean milk production.

VII. Traveling butter making schools.

VIII. Traveling cheese making schools.

IX. Cooperative dairy schools.

X. Fixed junior and senior dairy courses at county farm schools or institutes.

XI. Higher courses in dairying at dairy colleges.

XII. Dairy research at the National Dairy Research Institute.

PIONEER LECTURES (SUBSCHEME I).

These are for the most part occasional lectures delivered to country audiences. It may be that their purpose is to convey instruction in a particular subject in which the local farmers are interested and desire information, but, generally speaking, their real purpose is to arouse interest and thereby cause the local people to join in making an application for a visit to one of the traveling schools.

EXHIBITS, DEMONSTRATIONS, AND LECTURES AT AGRICULTURAL SHOWS (SUBSCHEME II).

At certain of our principal annual agricultural shows the Ministry of Agriculture directly provides an exhibit and arranges for the distribution of agricultural literature. Most of the exhibits are intended to illustrate the application of the results of research and experiments to practical conditions. Many of our agricultural colleges make exhibits at the chief shows held within their respective provinces, as do also the farm institutes or schools within their respective counties. At the local county shows, it is the usual practice for the local education authority to cooperate with show committees, in the holding of dairy competitions—such as practical butter making, etc.—and in the provision of demonstrations and lectures dealing with various phases of dairy work. Latterly a considerable feature has, in this connection, been made of demonstrations on how to produce clean milk.

BULL CLUBS (SUBSCHEME III) AND MILK RECORDING SOCIETIES (SUBSCHEME IV).

These two schemes, together with what has been referred to under Subscheme II, are the only exceptions to the general rule that educational assistance to the farmer is administered through local education authorities and agricultural colleges.

The Ministry of Agriculture is directly responsible for the drafting of these schemes and for the supervision of the work carried out under them. Grants in aid are made by the ministry direct to the clubs or associations that have been formed, and are working in accordance with the rules laid down in the respective scheme. Each scheme is operated independently of the other but they may be said to have a common object, namely, that through the improvement of the herd, economy in the production of milk may be effected and hence both the farmer and the consumer benefited.

ADVISORY WORK IN THE FEEDING AND MANAGEMENT OF DAIRY STOCK (SUBSCHEME V).

All colleges, farm institutes, and county staffs are available to the farmer for advice in this connection, but, in addition, very valuable work is being carried on in several instances by county educational staffs working in conjunction with milk recording societies. The societies supply to the educational staff particulars of milk yielded and the nature and amount of food consumed by the different herds, and from the information so supplied the farmer is informed as to the food cost per gallon of his milk and, if necessary, how that cost might with advantage be reduced.

COURSES OF INSTRUCTION IN CLEAN MILK PRODUCTION (SUBSCHEME VI).

From the earliest days this subject has been regarded as being of great importance, and latterly it has received very considerable attention. The instruction has now been given a more practical turn. During the winter period many of our county dairy instructors are engaged in conducting clean milk courses, the usual practice being to give a practical demonstration on a farm to which the public is invited, and afterwards to hold such number of evening meetings at that center, as may be necessary to explain the "why and the wherefore" of the precautions taken.

TRAVELING BUTTER MAKING SCHOOLS (SUBSCHEME VII).

The commonest and probably the most effective method of supplying itinerant instruction in butter making is by means of a traveling van in which the necessary equipment is moved from district to district. The instructor, usually a woman, has in most cases obtained a diploma at one of the recognized centers of dairy instruction. She has an assistant, a youth who sees to the supply of hot and cold water required and attends to the packing and conveyance of the equipment. The normal length of the course of instruction is a fortnight. Half an hour or an hour is taken up each day by lectures and demonstrations by the teacher and about two and a half hours by practical work. The class usually meets in the afternoon. This leaves the instructor free in the mornings to visit the homes of her students with the object of assisting them in applying what she is teaching in the school to their local conditions. At the close of each course it is the general practice to hold an examination of the students, and on the results of this examination it is in most cases the custom to offer scholarships to the most competent and deserving of the class members to enable them to proceed with a still higher training at a farm institute.

TRAVELING CHEESE MAKING SCHOOLS (SUBSCHEME VIII).

Previous to the war only a small number of these schools were maintained. Indeed, at that time only five were in existence, and it was principally because of the food difficulties occasioned by the war that the number of such schools was greatly increased, the idea being to secure the best national use of the milk produced and to provide instruction in the technical process of cheese making. The work of these schools at that time proved so successful that they have become a permanent feature in the educational schemes of many counties.

The system on which each school is worked is briefly as follows: It is equipped with a set of cheese making apparatus and with a competent instructor or preferably two instructors working alternately with the same plant. The school is held at a farm or any other suitable accommodation for a period of two to four weeks under the charge of one instructor, who at the end of the course spends the following two to four weeks in visiting the homes of the students who have attended, in order to assist them to start cheese making on their own account. At the conclusion of the first school period the equipment is moved to a new center and there placed in charge of the second instructor, who, in turn, following the close of the school at that center, remains behind to start this new set of students to work in their homes, while the first instructor resumes charge of the school at a third center, and so on, alternately.

As a means of breaking new ground in preparation for the work of a migratory school, single demonstrations in the making of small cheeses from small quantities of milk with improvised utensils is frequently adopted. This is a useful means of arousing the interest and of giving practical proof that the making of small cheeses is within the reach of most of the smaller dairy farmers.

Visiting instructors.—In certain of our counties where the number of cheese makers and the quantity of milk produced warrant it effective educational assistance is provided by means of visiting instructors whose duty it is to visit farmhouse dairies where assistance is sought by the occupiers. In such cases it is usual for the instructors to remain at each dairy from three to six days and, if necessary, to pay a renewed visit of brief duration later in the season. This instruction is provided with a view to improving the quality of the cheese made and is not to be looked upon as a method of teaching the uninitiated. Again, it is the usual custom to use the traveling cheese schools after the same manner as a traveling butter making school as a means of selecting the most competent persons to proceed for higher training through fixed dairy courses.

The extent to which these cheese schools are being employed may be briefly indicated by mentioning that for the six years, 1916 to 1921, inclusive, the average annual engagements were:

Traveling teachers employed	70
Traveling cheese-school workers	54
Centers at which schools were held	409
Persons instructed	5, 021
Farms visited	1, 560

COOPERATIVE DAIRY SCHOOLS (SUBSCHEME IX).

These schools had their origin in the success which attended the earlier working of the traveling cheese schools.

In conducting the traveling cheese schools it frequently happens that the quantity of milk offered by the local producers to the school for manipulation was considerably more than the school equipment could accommodate. This led the ministry to prepare the cooperative-school scheme and to urge its adoption on local education authorities. The main conditions laid down in the scheme are that before a school is undertaken at any center the milk producers in the district applying for a school must form a representative committee, which must undertake: (*a*) To provide the premises in which the school can be held; (*b*) to deliver at the selected center a stated minimum quantity (usually not less than 200 gallons) of milk daily; (*c*) to agree to accept payment for the milk supplied on a strictly cooperative basis, i. e., from the results obtained from the sale of the products; and (*d*) to take an active part in the business of the undertaking. These requirements being promised, the local education authority undertakes to conduct a school for a period of two or three months, or until such time as an adequate demonstration has been provided.

In practice the holding of a school has meant supplying an instructor and the necessary apparatus and carrying on at the same center for a full milk producing season. It has never been required that the milk producers applying for and obtaining a school must necessarily form themselves into a registered cooperative society. Instead the ministry has trusted to the effect of the demonstration, a trust which has proved justified, as up till now in all but a few cases a healthy cooperative society has been the outcome of the holding of a cooperative school.

Since this scheme was originated in 1916 the number of individual cooperative dairy societies existing in England and Wales has, in consequence of the holding of the schools, been more than doubled. The societies so formed have in several instances developed into considerable undertakings, but whether large or small they have brought new life into the districts where they are located. They have by introducing new business methods quickened life and stimulated farming to a greater intensity. Thus, it is reported from some of the districts where a cooperative dairy factory has been established that cow keeping has increased by amounts varying from 10 per cent to 100 per cent.

FIXED JUNIOR AND SENIOR COURSES AT COUNTY FARM SCHOOLS AND INSTITUTES (SUBSCHEME X).

There are at the present time 12 farm institutes and 7 other institutions functioning in a similar capacity—totaling 19 in England and Wales—which provide junior courses of instruction in the production of milk, in the technique of the manufactures, and in the rudiments of the sciences relating to dairying. These courses are largely attended by students who have passed with credit through a traveling school. In the case of several of the institutions, they are held during the summer when the purely agricultural students are not in session, but in other cases they are repeated throughout the year. The duration of the course varies from 5 to 13 weeks.

Senior or certificate courses, varying in duration from 14 weeks to 1 year (but usually the latter) are provided at 9 separate institutions.

HIGHER COURSES IN DAIRY COLLEGES (SUBSCHEME XI).

There are 6 institutions providing higher courses of instruction in dairying. These courses, while primarily intended to prepare students to sit for diplomas granted by the respective colleges, also cover, in nearly all cases, the syllabus of the examination for the national diploma in dairying (N. D. D) which is an independent examination conducted by the national examination board appointed jointly by the Royal Agricultural Society of England and the Highland and Agricultural Society of Scotland. The course requires two years residence and is intended to provide the student with a thorough training in practical dairy work and the sciences relating thereto. At some of the colleges the handling of milk on a large scale, such as occurs at dairy factories, receives special attention. It is through these courses that our teachers and many of our dairy factory managers are provided.

DAIRY RESEARCH (SUBSCHEME XII).

Each of the dairy colleges is in a position to carry on research; but as a general scheme of dairy education would not be complete without a central dairy research station, there was established in 1912, in conjunction with the University College, Reading, the National Institute for Research in Dairying. The equipment of this institute has been steadily improved, and it is now provided with suitable laboratories, etc., and land to the extent of 340 acres.

The functions of this institute are wide. Within its province are included all questions relating to the production, handling, and distribution of milk, and the manufacture of dairy produce.

The useful work which the institute has done during the 11 years of its existence has not only brought about a healthy spirit of cooperation between it, the dairy teaching centers and the traveling instructors, but has also gained for it the esteem of the more enlightened dairy farmers.

This account of the general scheme of dairy education in England and Wales is necessarily sketchy in order to conform to the limits set for paper readers. Many minor, but nevertheless important, schemes have perforce been omitted, but it is hoped that sufficient has been said to convey a general idea of the scope of the educational assistance which is being provided for what has become the most extensive branch of British agriculture.

Chairman Hatch. We will take a few moments for discussion, if you have remarks to make upon this presentation. Is there any discussion? If not, we will proceed immediately to the next paper, by Miss D. G. Saker, superintendent of dairy department, Cannington Court Farm Institute, England. Miss Saker. [Applause.]

THE WORK OF A COUNTY DAIRY INSTRUCTRESS IN ENGLAND AND WALES.

Miss Dora G. Saker, N. D. D., B. D. F. D., head of dairy department, Cannington Court Farm Institute, Somerset, England.

Mr. Chairman and gentlemen: In giving you this paper, I feel it is, to some extent rather out of place in a country where we are at the present moment because you have such a tremendous large area to deal with, and the work that we county dairy instructresses do in England and Wales is done only in very small areas.

For example, I am at present working in Somerset County. It is 100 miles from east to west and about 70 miles from north to south, and in that area we have 2,000 farms, 1,000 of those farms being cheese-making farms or milk-selling. So you will understand that the people are very much closer together. Therefore it is impossible to make comparison with the work which is being carried on in these large tracts that you see on this side. Therefore, I can only deal with the subject really from rather an insular point of view, but I am trusting that delegates from smaller countries like our own will appreciate it, perhaps, more than those from the larger countries.

Dairy instruction in England and Wales is given under the direction of the county councils in conjunction with the Ministry of Agriculture and Fisheries. The instructress is selected, appointed, and paid by the county council and works under the officers of the county, but her work is inspected at intervals by inspectors from the Ministry of Agriculture, who contribute largely to the expenses incurred, so that it is not entirely borne by the county rates. Dairy instruction, as with many other branches of work, is available to any rate payer in the county where the work is carried on, and, under these conditions, when application is made for the services of a dairy instructress the charge or fee is merely nominal and is payable to the county council authority and has nothing to do with the instructress. An instructress is expected to keep accurate records of the work done, with, if possible, the results of that work. Thus improvement in the prices obtained for dairy produce after help has been given shows the value of the instruction.

An instructress is also required, in the case of class work, to keep registers of attendance similar to those used in schools.

The work of a county dairy instructress as carried on in England and Wales may be divided up into five different sections:

1. Lectures and demonstrations.
2. Traveling or itinerant classes:
    (*a*) Milking classes.
    (*b*) Butter making classes.
    (*c*) Cheese making classes.
3. Temporary schools:
    (*a*) Farmhouse schools.
    (*b*) Cooperative cheese schools.
4. Advisory visits.
5. Permanent dairy schools at farm institutes.

1. LECTURES AND DEMONSTRATIONS.

This branch is placed first, as it is due to this work that much fresh ground is broken and the general public get to know of the facilities that are available. With regard to lectures, it is found that the winter is the most suitable time, both from the point of view of the instructress and also the country audiences. Owing to the shortage of milk, all class work is more difficult to arrange; therefore the instructress has more time available, and, on the other hand, in country districts where amusements are scarce lectures are appreciated to while away the long winter evenings. It is found that a course of lectures, say, from four to six, are most appreciated, and the course should cover the side of dairying particularly suited to the district, in addition to general dairy subjects. Thus in a milk-selling area, lectures on the production and preparation of milk for sale, with demonstrations on milk testing, etc., would be helpful, while in butter-making and cheese-making districts those respective subjects would be most popular. Demonstration work in conjunction with lectures usually appeals to the mind better than purely technical lectures and gives better results. Thus in a county where all three types of itinerant classes are being carried on, a course of three lectures with demonstrations might well include, in the first, milking with an artificial cow's udder and milk testing; in the second, a butter-making demonstration; and, in the third, the making of a small cheese with improvised or household utensils. This gives the audience a fair idea of the aims and objects of the work. They also get to know the instructress and are then not so diffident about joining classes when formed.

Demonstrations at agricultural shows are also found to be of great assistance, and this part of the work might be extended in dairying districts. Instead of butter-making competitions only being held, as hitherto, a working dairy with demonstrations in cheese and butter making, the separation of cream and the preparation and sale of all dairy products attracts the attention of visitors to the show, and they can then ask for any help they may need.

2. TRAVELING OR ITINERANT CLASSES.

Before dealing with the separate types of classes, the method of holding them all being similar, it may be discussed on general lines. The instructress engaged in this work visits the village or district where desired; and, having found suitable accommodations, holds a class for a period, usually 10 days. The time the class is held is arranged to meet the convenience of the pupils attending. A small fee of, say, half a crown, is charged for the course. At the end of the class an examination is held, either by the county agricultural organizer or by another instructress, and a certificate awarded to those who obtain above a set standard of marks. This examination is found to be most helpful to the work, for it not only sustains the pupils' interest in the work, but also keeps the instructress up to a high standard. It is so easy when teaching people who in some ways know less than the teacher for the latter to go back in her work without realizing that any such thing is happening.

Now to consider the three different types of classes mentioned:

(*a*) *Milking classes.*—An instructress engaged in this work must be a first-class milker and know how to manage cows, for in addition to finding a room, etc., a farmer who is willing to lend his cows for the use of the pupils must be found. The usual practice is for the pupils, generally school children, to meet for the first few days in a room, and learn the mechanical action of milking on an artificial cow's udder. The udders used are on stands and made of rubber, having an orifice at the base of the teat which resembles the sphincter muscle of a cow's udder. They hold from 2 to 3 gallons of water, and the pupils are taught to approach them in the same way they would a cow and use the similar action in milking. When they are proficient they are then allowed access to the cows. In this way the damage to the cows is very slight. In addition to the mechanical action of milking, the pupils are taught to have clean conditions during milking and the correct methods of cleansing milk vessels.

(*b*) *Butter-making classes.*—This system of teaching butter making was the first kind of traveling class introduced into this country, and up to the period of the war it was the principal type of dairy instruction practiced on itinerant lines. The great difficulty in this class of work is the bulky plant, and for this reason in many counties the instructress moves from center to center with a van for the plant. Where it is dispatched by rail the equipment is usually restricted to six churns and six butter workers, and, therefore, if there are any pupils over that number they have to work in pairs. Cream is usually purchased and sent to each center, the pupils themselves bringing their own cream to churn if they particularly wish to do so. The disadvantage of this work is that the pupils do not have instruction in the preparation of the cream for butter making, which of course is one of the main causes of failure in the making of high class butter.

(*c*) *Cheese-making classes.*—Until the war very little work of this kind was done in England, but the shortage of cheese gave great fillip to the making of cheese on a small scale, with small quantities of milk which would otherwise have been fed to stock.

The equipment of a traveling cheese class should consist of a complete outfit for making cheese on a very small scale, and in addition various improvised utensils to illustrate that it is not essential to expend a large amount of capital. These classes are especially intended for the families of small farmers who may wish to make the best use of any small quantity of surplus milk they may have in the flush period of the year. Each pupil attending—usually there are 8 to 10—makes a small cheese daily with improvised utensils, the amount of milk dealt with being from 2 gallons upward. The variety of cheese made varies, according to the district.

In addition to the practical work of these three kinds of traveling schools, the pupils are given short talks or lectures on dairy subjects. It is found that these classes create a great interest, and pupils after attending these short courses are anxious to go to fixed centers for further training.

For the successful working of these classes the aim of the instructress is to convert, as far as is possible, the room where the classes are held into a dairy, and to instill into the pupils the fact that the law of cleanliness must be carried out in all operations connected with dairy work. If this is accomplished much good work can be done, and the pupils learn by careful attention to detail the elements of successful work on larger lines.

3. TEMPORARY SCHOOLS.

Under this heading we may consider the two types of schools that are held at certain centers for three to nine months.

(*a*) *Farmhouse schools.*—These are usually for cheese making, but occasionally are held for butter making. In the former case these schools are only held in counties and districts where the practice of farmhouse cheese making is the ordinary method of milk disposal. A farm is selected, and the pupils come to this farm to be taught by an instructress for periods varying from one to four weeks. Board and lodging are provided in the farmhouse, and the teaching is similar to that practiced in a farmhouse. The pupils attending are usually farmers' wives, daughters, and sons, or people wishing to receive training to go out as cheese makers.

The school moves each year into a different district, a fresh farm being selected. It is thought in this way that more pupils are obtained, as many can attend for daily instruction who can not leave their homes for any length of time.

Much useful instruction has been given in the past by this system of temporary cheese school, but the disadvantage is that it is not progressive enough for present needs. The expense of fitting up a fresh farm each year is great, and as the accommodation for students is limited, it is questionable whether the good done is commensurate with the amount expended. These schools can only be of service in certain districts and are not found away from cheese-making areas. The type of temporary school for butter-making classes is not very common, but a room is sometimes selected and fitted up for the purposes and classes held for one to three months. At these centers the working of a separator is demonstrated with the best methods of treating cream, and therefore a further stage of instruction is given beyond that obtained at a traveling butter school.

(*b*) *Cooperative cheese schools.*—These schools are arranged to be held at centers where there is likely to be a surplus supply of milk during the flush season, the object being to demonstrate to farmers the advantages of cooperation in this respect. A committee of farmers and those interested is formed, suitable accommodation is found, and the dairy is equipped to handle the amount of milk likely to be available. The instructress in charge superintends the working of the concern, taking the pupils from the district, and staying sufficiently long at the center until she has trained someone to be capable of carrying on. After the school has been run for some months every assistance is given in showing those interested how to continue as a cooperative society. Surplus milk in this way is converted into cheese with the least possible expense and labor. A glut is also prevented which would otherwise result in waste. At these schools the amount of milk dealt with varies, but it is not usually considered advisable to start with less than 250 gallons daily. This amount may, of course, increase and the quantity ultimately amount to thousands.

4. ADVISORY VISITS.

The fourth section of a dairy instructress's work is perhaps the most difficult of all, and in addition to a thorough knowledge of her subject she requires a great deal of tact if success is to be obtained.

There are, roughly, two kinds of advisory visits. First those which one may term "calls," when the visit only lasts an hour or so, and the second kind when a stay in the house for a period of time varying in length up to a week is made.

Visits of advice in England are usually only paid when invited. In this direction dairy instruction in England differs from Scotland. In Scotland a system of visits is carried out, the instructor calling at any time or place he considers advisable. Calls for advice are usually asked for after an instructress has been lecturing or demonstrating in a district. That such advice is available is usually announced on the bills advertising the lectures. These visits embrace all branches of dairying.

The second kind of advisory visits is usually only asked for in a cheese-making county. Thus if a farmer's wife, daughter, or cheese maker is in some difficulty, application is made for the help of an instructress. The object of these visits is not to teach cheese making, but to give help to those who already can make cheese, but require further knowledge. For the best results in this work, the instructress watches the method practiced the first day, offering no advice until she sees the result of the method practiced. Then the second day she takes control of the dairy, making the cheese entirely herself and altering as she judges fit. Provided her alterations show an improvement, the next day and days following, the instructress and the cheese maker work together with the fresh method, and the instructress stays until the cheese maker feels confident to carry on without her assistance.

The farmer applying for these visits of advice pays a small fee (e. g., 10 shillings) and provides accommodation for the instructress, conveying her to and from the nearest station or farm at the beginning and conclusion of her visit.

5. PERMANENT DAIRY SCHOOLS.

Under this section we may consider the work carried out as being the fountainhead of instruction, help, and advice, given in the particular county where the dairy school is situated. The permanent school should demonstrate the ideal conditions prevailing in the different branches of dairy work. For this it is essential that not only should there be a well-equipped school carried on along business lines, but also a herd of dairy cows, so that the production and treatment of milk can be taught in all its branches.

An instructress at a permanent school is required to have a knowledge of all the previously mentioned branches of the work so that the staff working in the county can offer her help to the people with whom they may come in contact, so that should they not be available, help can be obtained from a fixed place. Apart from the training of students, these centers may be of untold value for advice and should be situated at a convenient place, centrally in a county, so that they can easily be visited when help is needed.

With regard to the work of an instructress at a permanent school, this is extremely varied and ranges from teaching students entirely ignorant of dairy work to training for examinations.

Courses of varying lengths are arranged; but in addition to the students attending these courses, others come for shorter periods and for special subjects. This entails additional work for the teacher as regards practical instruction, and creates a great difficulty in giving the necessary theoretical subjects. The ideal would be to teach these short-course people at a special time, but to do this it would be impossible to suit the public convenience.

The length of courses provided at these permanent dairy schools varies from one month to one year, and the ground covered varies accordingly. For the longer periods the practical work embraces milk production, handling, and sale, production and sale of cream, butter making, and the making of soft and hard cheese. The theoretical side of the work, in addition to the above, should include a certain amount of dairy farming, dairy bacteriology, and dairy chemistry.

It is advisable that the instructress and students should be resident at these permanent schools, as the long hours necessitate close attendance, and dairying can never be crammed into an eight-hour day.

In making this survey of a dairy instructress's work it is difficult to give to any sections mentioned the palm for giving the best results. Each branch dovetails into the other, and one is so often a stepping stone to the next. As regards which is the most congenial to the instructress, that is, perhaps, not such a debatable point. Most who have tried all branches prefer the work of a permanent school, even if the hours are longer and the work more strenuous. None of it can be classified as monotonous if the instructress is keen and the itinerant workers have the heartening knowledge that they are, as it were, more likely to touch the spot where help is needed. The permanent worker might, but for them, stay in one place and do very little good, but with all sections working together the permanent school is fed by the traveling instruction. The work goes on; as the younger generation grow up they need help, so that it is never possible to say that the ground is all covered. Until all dairy produce is uniform and of high grade, dairy instructresses will be required to "carry on."

Chairman HATCH. We will take the usual time for the discussion of this presentation. Do you have any questions or remarks to make?

Mr. G. F. GOSNEY (secretary, National Association of Creamery Proprietors, England). I would like to say, as a matter of interest, that I was born in the county Miss Saker has been working in. It is given to very few teachers to see, in the course of their lifetime, the results of their work, but in this particular instance I should like to congratulate Miss Saker, and those who have been working with her, upon the results which they have obtained.

As a result of the work that has been carried on in that particular county, which is the home of Cheddar cheese making, the returns have been enormous, both in regard to the quality of the product and, incidentally, which always follows, to the price obtained for it.

Of course, I do know that lack of funds has prevented the work being carried to the extent that the educational authorities would have liked it to be carried, but at the same time I would like to add my humble testimony to the value of the work that has been done in my own county. [Applause].

Chairman HATCH. Are there any further remarks, any other questions?

Mr. GEORGE A. PUTNAM (director of dairying for Province of Ontario, Canada). To what extent has this instruction resulted in the establishment of creameries, or do you advise that as the ultimate object of your efforts?

Miss SAKER. I might state that the instruction that we carry on has nothing to do with factories. We give help to factories where they ask for it, but our instruction is primarily to help the individuals in their own homes and not the large depot.

The difference with England as compared with these larger countries is that there the stuff is used on the spot. It is not carted away to another center. Our object is to prevent waste in the home.

I am more especially interested in cheese making. We can always get 10 to 20 shillings per hundredweight more for farmhouse cheese than factory cheese. The supply never meets the demand. As long as we can make first-class farmhouse cheese, we can always sell it.

Mr. E. M. SHERMAN (Iowa State Dairy Association, Charles City, Iowa). I would like to know if this work is always done by the women.

Miss SAKER. I think I can safely say that with the exception of about two men in England who do this farmhouse work, it is all done by women; in Scotland, however, it is nearly all done by men.

Mr. BLACKSHAW. I think one of the questions asked referred more to the remarks I made than to those of Miss Saker. You asked to what extent the instruction provided led to the formation of creameries or cooperative dairies. In reply to that I can't give you the actual figures, but I do know that since the institution of cooperative schools, which was in 1916, the number of factories resulting from the schools, directly or indirectly, has more than doubled the total number of factories in existence at the time the school was started.

Chairman HATCH. Is there any further discussion?

Mr. E. M. SHERMAN. This to me, Mr. Chairman, is a mighty interesting paper. I think it is one of the most interesting I have heard. I think there are many phases of it that are adaptable to America, although in this country we have very different conditions to face. As a rule, our population is not so dense and our work would have to be more scattered.

However, I find that much of the best and most useful work that is being done by our colleges to-day is done by our extension service, and I believe there are phases of this thing that can be carried into our homes to mighty good advantage. [Applause.]

Miss SAKER. I neglected to say that one of the main factors in the success of this work depends upon your method of getting about. Then, too, an instructress must be physically fit to brave all weathers.

In our county if we motored to the farms we should be considered "swank."

One must have a mode of getting about and getting around easily, so as to actually get on the spot while the work is being carried out.

Chairman HATCH. Has anyone else anything to say on this subject?

Mr. GEORGE A. PUTNAM. Canada is very much like America in many respects, and I am wondering if we are stressing too forcefully the centralization of our efforts. I may say that as late as 1894 and 1895 we had our traveling dairies, and that resulted in the establishment of creameries, so that nearly all our butter is now manufactured in the creameries and all our cheese is manufactured in cheese factories.

I think the paper just presented gives us food for thought as to just what extent we should endeavor to develop, in so far as the size of the individual manufacturing plant is concerned.

Chairman HATCH. Is there any further discussion? If no one else has any remarks on this question, I would like to ask if Doctor Swaving, of Holland, is present. He does not seem to be. There were several papers that were placed at the end of the list. There are three ways in which we can proceed: First, we can have them incorporated in the record; second, we can ask that the papers be read, as I understand that there are personal representatives of two or three of the people here who will consent to read them; or, third, we can have these gentlemen give short synopses of the papers and place them in the record.

What is the pleasure of the session with reference to this procedure on the remaining papers?

MEMBER. What are the remaining papers?

Chairman HATCH. They are "Task of the Government dairy experts with regard to matters of dairying;" "Dairy instruction given by the cooperative dairy organizations in the Netherlands;" "Educational and advisory work in dairy farming through the agency of milk recording societies," by Mr. Garrad and Mr. Mackintosh. I understand that Mr. Garrad and Mr. Mackintosh are personally represented by Mr. Steele, who has a statement to make with respect to that, provided it is the wish of the session. I also understand that Mr. Stevenson, of Scotland, is represented by Mr. James Dunlop, of the subcommission of small holdings of the Board of Agriculture of Scotland. He is prepared to make a brief statement with respect to that paper.

Mr. E. M. SHERMAN. I move that they be asked to give synopses of these papers.

(The motion was seconded, and carried.)

Chairman HATCH. We will ask Mr. Steele to give us a five-minute synopsis of the paper of Mr. Garrad and Mr. Mackintosh. [Applause].

Mr. STEELE. Mr. Chairman and friends: It is unfortunate that neither Mr. James Mackintosh nor Mr. Garrad is able to be here, but their duties have bound them so closely at home that they were quite unable to come to America.

(Mr. Steele read an abstract of the following paper.)

EDUCATIONAL AND ADVISORY WORK IN DAIRY FARMING THROUGH THE AGENCY OF MILK RECORDING SOCIETIES.

G. H. Garrad, N. D. A., agricultural organizer, Kent County Council, and James Mackintosh, O. B. E., N. D. A., N. D. D., National Institute for Research in Dairying, Reading, England.

The object of this paper is to describe the development in England of systematic advisory work on the feeding of dairy cows, through the organization of milk recording (or cow testing) societies; to give some examples of the methods adopted and the results obtained and to indicate the great educational value of such work to the dairy farming industry.

It will be necessary as a preliminary to describe the system of milk recording or cow testing in practice in England and Wales.

The practice of keeping records of the milk yield of individual cows was introduced into dairy herd management in the middle of last century, but progress was very slow, and development on any systematic basis has taken place only within the last 15 years. Agricultural colleges, county councils, and dairy breed societies did excellent pioneer work and paved the way for the initiation of a national scheme by the Ministry of Agriculture in 1914.

The basis of this scheme is the formation, by a group of farmers, of a properly constituted milk recording society, for a stated district or county. Any such society will receive a money grant from the Ministry of Agriculture at the rate of from £3 to £3 10s. per herd per annum, provided the society carries on its work on the lines laid down in the official regulations issued by the ministry. The essential points in these regulations are that the members of the society must agree to weigh the milk of all cows in their herd daily, or at least one evening and the following morning, each week, adhering to the same days each week, and make the necessary entries in the record sheets and books provided by the ministry; that the society shall employ a recorder to make surprise visits to each farm at intervals of not less than six weeks for the purpose of checking the weighing of the milk and the entries and calculations made by the farmer, and that the ministry shall supervise the working of each society by means of its own district livestock officers and shall, on application, on receipt of the stated fee, and provided the necessary information has been forwarded to headquarters by the society, supply to each farmer a certificate of the yield of any cow or heifer for any year or part thereof.

Since this scheme was launched in 1914 excellent progress has been made in spite of the tremendous difficulties of the years 1914 to 1918. For the year 1921-22 there were 55 societies in operation, with 3,921 members and recording 100,933 cows. It affords material satisfaction to those who chaffed at the slow progress previous to 1914 to know that there are now 55 societies scattered throughout England and Wales, whose records of milk yields are taken and checked on a definite and regular system, and under the supervision of a Government department. No higher warrant of reliability could be required.

The milk recording societies operating under the rules and regulations of the Ministry of Agriculture can, in addition to the duties briefly outlined above, undertake the marking of calves for future identification, the testing of samples of milk for their members, and arrange for the taking of records of the rations given to the different herds and the provision of advice thereon. The remainder of this paper will deal with the last mentioned subject.

During the years 1908 to 1914, preceding the introduction of the national scheme for the development of milk recording, several agricultural colleges, notably the South Eastern Agricultural College, Wye, Kent, the agricultural department of the University of Leeds and University College, Reading, had formed milk-recording circuits in their own areas and carried out at the same time, investigations into the composition and cost of the rations used on the farms visited.

The reports on these investigations issued from the different centers demonstrated a great variation in the practice of feeding and a remarkably wide range in the cost of the daily ration and the cost of food per gallon of milk.

Differences in methods of calculation of the cost of rations, especially with reference to the food grown on the farm, accounted to some extent for the wide variations found in the cost of feeding in the different circuits. They were not, however, responsible for the wide variations that were found on different farms in the same circuit, because on these farms mangels, hays, and the other home-grown foods were charged at the same price per ton in every case. A study of the weights of the different foods constituting the daily rations showed beyond the shadow of a doubt the great need for the provision of advice to farmers on the balancing of rations and on the feeding of cows in relation to their milk yield.

The following examples give some measure of the range of variation in rations and cost found in the same investigations:

	Daily yield per cow.	Daily cost of ration.	Average daily rations.				
			Roots.	Hay.	Straw.	Wet grains.	Cakes and meals.
KENT.							
Winter of 1911–12:	*Pounds.*	*Pence.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Herd E	19.90	9.90	56	5	6	34	Nil.
Herd G	20.03	18.70	66	22	Nil.	40	3.0
Winter of 1912–13:							
Herd C	21.70	9.33	36	3	7.2	Nil.	7.0
Herd A	23.30	17.38	99	9.5	7.5	Nil.	9.1
Winter of 1913–14:							
Herds A, B	19.70	9.56	77	6.1	4.6	Nil.	4.0
Herds A, G	22.90	15.31	70	13.7	1.4	15.9	8.3
Winter of 1920–21:							
Herd A	19.60	20.32	50	Nil.	10	10.5	3.0
Herds B, E	18.15	46.29	100	Nil.	20	Nil.	7.0
Winter of 1921–22:							
Herd 23	21.79	16.41	28	6	10	Nil.	5.5
Herd 58	26.66	46.68	51	8	10	20	13.0
Winter of 1922–23:							
Herd 18	20.00	11.09	48	Nil.	7.5	Nil.	5.7
Herd 113	18.33	33.14	90	5	20	Nil.	12.0
BERKSHIRE.							
Winter of 1913–14:							
[1]Herd CXVIII	19.77	7.44	52	5.2	5.6	Nil.	4.7
[2]Herd CIX	23.07	17.14	139	18.3	6.6	20.0	Nil.

[1] Herd CXVIII.—Cows in poor condition, obviously underfed.
[2] Herd CIX.—Ration much too watery and badly balanced.

The formation of district and county milk-recording societies shortly after the publication of the results above referred to, provided an organization of dairy farmers whereby information could be collected on the quantity and kinds of foods used for the feeding of cows on different farms and facilitated the provision of advice when necessary on the preparation of a properly balanced or more economical ration.

Schemes for this advisory work were devised and introduced chiefly in the districts where the earlier investigations had been carried out and where the farmers had had the greatest opportunities of realizing the advantages to be derived from cooperation with agricultural colleges and county agricultural organizers. The details of the schemes vary slightly from county to county, according to local conditions, but the general method is the same.

The method usually adopted involves little extra work for the members of the milk-recording society. At each visit of the recorder the member has the option of obtaining the recorder's assistance in weighing up the daily ration given to the cows in milk. The recorder has a food-record book, and having ascertained the weight of the foods, their prices (if available), and the method of feeding, he fills in a page of his book (in duplicate), tears it out, keeping a carbon copy, and posts it to the adviser's office. The carbon copy is kept in the book and is useful for future reference in case the first copy gets lost or any correspondence relating to the food record becomes necessary between the recorder and the adviser. The recorder sets out on the food-record sheet the number of cows in milk, their breed and approximate weight, their condition (good, average, or low), and the quantity of milk given on the day of his visit, in addition to the detailed information as to the ration being fed.

On receipt of the food record from the recorder the adviser works out the daily cost of the ration per cow, the cost of food per gallon of milk, and the composition of the ration (usually in terms of digestible protein and starch equivalent) and sends this information, together with his suggestions for improvement or economy in feeding, to the member for his information and guidance. In order to encourage competition the member is in many cases informed how his milk yield and cost of feeding compares with other members' figures. It is desirable that a copy of the information and advice sent to the member should also be sent to the recorder who submitted the food record sheet in the first place. Such a practice keeps the recorder interested in this side of his work and may assist him in his future dealings with the farmer concerned. It is also important that the member should receive the information that he is seeking from the adviser as soon as possible, e. g., within a week after the food-ration sheet is submitted, before his interest has flagged.

It has been stated that in some schemes the member is informed how his cost of feeding compares with the average of other members submitting food records. These comparisons lead to a good deal of friendly rivalry, which helps to stimulate each member to improve his own figures. He may be allowed, in the first place, to put whatever price per ton he thinks fit on the various home-grown foods he is using, and the cost of his ration will be calculated out for him on the basis of those figures. There is always a very wide variation in the prices per ton selected by different individual farmers for such foods as hay and mangels, and it is therefore difficult to compare the cost of feeding on one farm with the cost on another. To get over this difficulty a committee may decide at the beginning of the season what price is to be charged per ton on every farm for mangels, swedes, cabbages, hay, straw, and other home-grown foods, and these prices will be adopted on every farm. Another way out of the difficulty is for the adviser, toward the middle of the winter season, after scrutinizing all the prices that are being charged by members, to fix on a price for each individual food and to calculate afresh the cost of each ration, using these prices in every case.

The adviser is thus able to get a fairer comparison between the cost of feeding on the different farms and to prepare a statement for circulation amongst all the members of the society. The identity of each individual member is hidden by giving him a code number. Such a statement may contain information about every herd under the following headings: Code number of herd, number of cows in milk, day's yield of milk, daily cost of food per cow, cost of food per gallon of milk, quantity (in pounds) of roots, silage, wet grains, hay, straw, cakes, and meals being fed per cow per day, quantity of digestible protein and starch equivalent in the day's ration, and the theoretical requirements in terms of digestible protein and starch equivalent of cows of that size, breed, and giving that quantity of milk. From these figures each member, who is informed of his own code number, is able to compare his own ration and results with those of any other member of the society.

The food-recording scheme is usually confined to the winter months, because in the summer the cows are grazing and obtain the greater part, if not the whole, of their food from the grass. Grass varies enormously in quantity and feeding value, and there is no accurate means of estimating either, so that an adviser is less able to help the member during the summer months.

The cost of taking the food records is practically nil, and there is no extra charge for it. The recorder visits each farm in the course of his ordinary duties, once every six weeks or thereabouts, and he has ample time, in addition to seeing the milk of each cow weighed, checking the milk-record sheets, and marking the calves, to superintend the weighing of the foods being fed to the cows.

Some members are content to submit one food record sheet during the course of the winter; others may submit them regularly at every visit of the recorder. From the point of view of the adviser it is unsatisfactory to receive only one food record because he gets no opportunity of learning afterwards whether his recommendations have been carried out and with what results, whilst if food record sheets are submitted at regular intervals from the same herd of cows he is able to obtain some very useful information as to the effect of alterations of feeding on the milk yield of the cows. Members frequently submit three food records, and occasionally four, in the course of one winter season. Advisers who have carried out this work on a large scale for a series of years are gradually accumulating a vast store of facts and figures which may be of considerable value to research work in years to come.

It is essential that the adviser on rations and feeding should have a sound knowledge of the composition of foods and the scientific principles governing the preparation of rations for different purposes, and also practical experience in the feeding of dairy cows, preferably under conditions similar to those obtaining on the farms for which he acts as adviser. As a rule, therefore, arrangements are made by the milk recording society whereby the county agricultural organizer, or the principal of the county agricultural institute, or some member of the agricultural staff of the provincial agricultural college gives the necessary advice. This arrangement also facilitates inquiry into specially interesting rations by a personal visit on the part of the adviser and provides a means whereby samples of foods can be taken for chemical analyses where this course is considered necessary or desirable.

On the other hand, it is most important that some information be supplied by the members as to the available home-grown and purchased feeding stuffs, the breed of cows in the herd, and their present condition and milk yield, also the purpose for which the milk is produced, whether for immediate sale or for butter making or cheese making.

Where food recording in conjunction with an advisory system has been taken up by milk recording societies, those members who have taken the trouble to weigh the ration given to their cows have in many instances been enabled to reduce appreciably the cost of milk production; further, the economy suggested has often been capable of immediate application and the farmer has reaped the benefits of the scheme within a few days of his participation therein. There are, unfortunately, but few points in farming practice where the educationalist can give the inquirer such immediate evidence of the advantages of combining science with practice.

During the winter of 1920–21, 23 members of the Kent Milk Recording Society had two or more food records taken by the recorder during the course of the winter and a comparison of the first food record with the second food record gives the following results:

	First food record.	Second food record.
Number of cows	505	481
Daily yield per cow per day ..... pounds..	20.79	22.58
Cost of food per cow per day ..... pence..	33.39	31.00
Cost of food per gallon of milk ..... do....	16.06	13.73

These figures show that at the time the second food record was taken 481 cows in 23 herds were producing daily 1,086 gallons of milk (2.26 gallons each) at nearly 2½ d. per gallon less cost than at the time the first food record was taken. There were 30 other herd owners, owning 570 cows. that had one food record taken, but not a second one, so that no information is available as to the amount of benefit each of them derived from the advice they received; but it seems fair to suppose that they derived the same amount of benefit as the 23 herd owners mentioned above, i. e., they also were able to reduce their cost of production by nearly 2½d. per gallon. On that assumption the 53 owners of 1,051 cows were able to save £10 9s. 3d. a day in the feeding of their cows, which is equivalent to £1,883 5s. during the winter period of 180 days, and they were able to increase their yield of milk by 188 gallons a day, or by 33,858 gallons during the winter period. This is the result obtained by 53 members of one milk-recording society in one winter season from the inclusion of a food-recording scheme in the ordinary operations of their society.

The following instances, taken from the advisory work in different counties, exemplify the immediate and considerable economies which have been made by individual farmers:

A. BERKSHIRE.

	1912, December.	1913, January to March.	1914, December to March.
(*a*) *Farm near Reading:*			
Cows in milk	45 to 50	45 to 50	46 to 58.
Daily yield per head	2.33 gallons	2.45 gallons	2.61 gallons.
Cost of ration per head	17.40d	12.76d	13.33d.
Cost of food per gallon of milk	7.48d	5.21d	5.12d.
Saving per gallon		2¼d	2¼d.
Saving for season		£89 14s. 4d	£163 1s. 0d.

	1912–13, December to March.	1913–14, December to March.	1914–15, December to March.
(*b*) *Farm in the Reading district:*			
Cows in milk	34 to 39	30 to 39	37 to 42.
Daily yield per head	1.87 gallons	1.93 gallons	1.90 gallons.
Cost of ration per head	13.65d	9.25d	8.80d.
Cost of food per gallon of milk	7.32d	4.79d	4.61d.
Saving per gallon		2½d	2½d.
Saving for season		£88 15s. 2d	£98 7s. 3d.

The following are some individual cases for the winter of 1921–22:

B. KENT.

	First food record.	Second food record.
(*a*)		
Cows in milk	13	13.
Daily yield per head	25.9 pounds	25.9 pounds.
Cost of ration per head	35.31d	28.01d.
Cost of food per gallon of milk	13.62d	10.80d.
Saving per gallon		2.8d.
Saving per month during winter		£11 7s. 6d.
(*b*)		
Cows in milk	24	24.
Daily yield per head	17.9 pounds	20.4 pounds.
Cost of ration per head	41.82d	34.39d.
Cost of food per gallon of milk	23.35d	16.82d.
Saving per gallon		6.5d.
Saving per month during winter		£30 15s. 0d.

The following instances occurred during the winter of 1921–1922:

C. EAST SUSSEX.

	First food record.	Second food record.
(*a*)		
Cows in milk	28	29.
Daily yield per head	2.52 gallons	2.68 gallons.
Cost of ration per head	34.88d	27.47d.
Cost of food per gallon of milk	13.84d	10.25d.
Saving per gallon		3½d.
Saving per month during winter		£30 12s. 6d.
(*b*)		
Cows in milk	25	27.
Daily yield per head	2.16 gallons	2.26 gallons.
Cost of ration per head	42.17d	36.85d.
Cost of food per gallon of milk	19.5d	16.5d.
Saving per gallon		3.0d.
Saving per month during winter		£21 7s. 6d.

D. WILTSHIRE (1922–23).

	Before advice.	After advice.
Cows in milk	20	20.
Daily yield per head	1.80 gallons	2 gallons.
Daily ration of concentrates	3 pounds linseed cake, 8 pounds oats.	3 pounds oats, 2 pounds coconut cake, 2 pounds undesiccated ground nut cake.
Saving per gallon		2d.
Saving per month during winter		£10.

One very marked result of this feeding advisory work has been the gradual increase in the number of dairy farmers who "ration" their cows. When the Kent Milk Recording Society was started in 1916 practically every member fed all his cows alike. It is now exceptional to find a member who does not ration each individual cow in strict accordance with its yield of milk. One of the principal objects of the milk-recording scheme is to find out definitely how much milk each cow is giving per day and per year, and one of the great advantages derived from knowing the cow's daily yield is that the owner is able to prescribe her ration. Thus milk recording and food recording go hand in hand, and the latter is really complementary to the former. The advantages to be derived from milk recording are not fully realized unless it is accompanied by the rationing of the cows.

The examples given above are taken primarily from counties in the south of England, where this work is most fully organized, but many milk-recording societies in other counties are introducing similar schemes and making arrangements to provide their members with the opportunity for similar economies.

It is not contended that every dairy farmer can so change or reduce the ration given to his cows as to bring about an economy of pence per gallon in the cost of feeding, but there is no doubt that the operation of such an advisory scheme provides a means whereby even the best farmer can obtain a most desirable check on the cost of feeding his own herd; in fact, it is often found that those farmers who are least in need of advice on feeding are the most anxious to submit their rations for criticism in order that no loophole for wasteful feeding may escape their notice and that every opportunity for economy and improvement in the selection and utilization of foods may be made full use of.

Local conditions of farming—either geological or geographical—may necessitate considerable variation in detail in the schemes most suitable for different districts. Also, after a few years' experience, a society may develop its scheme so that additional information is obtained on some points of local importance, such as the relative importance of home-grown and purchased foods in the selection of economical rations.

The main point, however, should never be lost sight of, namely, that the chief object of the scheme is to aid each farmer in studying his own conditions so that he may thereby be enabled to increase his profits or reduce his losses.

In mentioning the development of milk recording in England and Wales at the beginning of this paper emphasis was laid on the fact that in 1922 there were 3,291 farmers having the milk yields of their cows checked and vouched for by 55 societies. The number of farmers taking advantage of food recording and advisory schemes is as yet probably numbered only in hundreds, but there are sure indications that the popularity of this work and the numbers taking part in it will increase in the near future at least as rapidly as the membership of milk-recording societies. In the future the scope for development and the advantages which will accrue to the dairy farmer are well-nigh unlimited. There is no reason why the membership of milk recording societies should not be increased tenfold, nor why all these members should not keep careful records of the rations given to their herds and make sure that they are feeding on sound and economical lines. Such a development is possible within a comparatively short term of years and could not fail to lead to the more economical production of milk, and to a material improvement in the quality and productiveness of the nation's dairy stock.

In addition to the direct benefits gained by dairy farmers through systematic milk recording and advisory work in feeding, the work of such societies provides a valuable stimulus toward better herd and farm management. Farmers who find that attention to detail in the milk yields and feeding of their herds brings about an increase in yield and a decrease in the cost of production, see for themselves or are easily led to see the advantages of applying the same general principles to other branches of farm work. The work is of the kind which helps the farmer to help himself, provides material for self-education and brings men with common interests together for helpful discussion. Further, the farmer is brought directly in touch with helpful advisers and is led to ask for advice and assistance on other matters affecting his soil, crops, and stock; in this way he comes into closer contact with the accumulated results of agricultural experiment and research. This contact widens the outlook and stimulates the mind, and by bringing new light to bear on the old problems and customs, leads to a reconsideration of practice and the adoption of improved methods and develops a new and deeper interest in all branches of herd and farm management.

Chairman HATCH. It is now 5 o'clock. We have just a short time to conclude this program and get our dinner before the arrival of the automobiles to take us to the dairy show. I would like to ask Mr. James Dunlop if he will kindly give us a three-minute continuation of the same subject, "Milk recording in Scotland." Mr. Dunlop. [Applause.]

Mr. JAMES DUNLOP. Mr. Chairman, Mr. Honorary Chairman, ladies and gentlemen: It is with considerable trepidation that I follow such an able fellow countryman. Mr. Alex Steele is a Scotchman who went down to England over 30 years ago and has taught the Englishman how to farm. He wins the gold medal every year for the best-managed farm. It is not a question who will be first; it is a question who will be second. America did well by Andrew Carnegie. England has done well by Alex Steele. Andrew Carnegie left us libraries and public halls in Scotland. I have often wondered what form the Steele benefactions would take, but I now believe from the keen sympathetic interest he has shown in the reading of that paper on dairy research that he will do something handsome for our new research institute in Scotland, so ably managed by Doctor Orr but seriously hampered by lack of funds. [Applause.]

Well, in connection with milk recording in Scotland, you have a fine synopsis of Mr. Stevenson's paper in your hands, so that I need not take up your time repeating what he has so well said. I would just like to say that in this work Scotland leads; England and Ireland follow. We started 20 years ago as the result of visits the late John Speir, along with one or two others of us, paid to Denmark and saw what they were doing there. We came home and got work started in a small way.

We had great opposition at first because the Scotch farmer was of the opinion that he had the best cows in the world; that his cows, which had been bred and improved for 150 years, had reached the maximum of production. Robert Burns, our national bard, was an early improver of the breed. I would like to say that they were remarkable cows, not so much for what the farmers did for them but because of what the farmers' wives and daughters, who milked and attended to them, did for them.

The Ayrshire cow was for many years almost the only milk breed we had in this country. As showing the high standard of production of the average nonpedigreed Ayrshire cow, they invaded the great dairy show in London a year or two ago, and the principal winners were nonpedigreed Ayrshire cows. Well, we had a difficult job at first, but the work gradually grew until last year we had about 30,000 cows tested. Every cow in the herd has to be tested each year, not merely once in the cow's lifetime when circumstances are abnormally favorable, as is the custom in some countries.

The Scottish Milk Records Association covers all dairy breeds of cattle. The association is against competitive records. We started, under Mr. Speir's leadership, with the idea that the records were primarily for the information of the individual farmers, so that they could weed out the bad cows and increase the average yield of the herd and ultimately eliminate from the country the uneconomic dairy cow. The milk records of one farm are not comparable with another unless you know at what cost they are produced. Professionals in every country want to make records as a short cut to make money by advertisement. Luckily we have economists and statesmen like Doctor Douglas and Sir Hugh Shaw Stewart in our association who keep us on sound lines.

Excessive records do not altogether depend upon the cow. Like the winning of the Derby, they often depend more upon the trainer. I know something about that. I have studied this matter in various countries. It does not seem to me that it does a breed any good to select a few animals in a herd with exceptionally strong constitutions and train them before they calve and after calving feed them scientifically so as to compress the production of a lifetime into one or two abnormal records. It means a short life and a comparatively barren one. Many of them die before the record is completed; few of them survive and breed again. Is any record worth killing a cow for? I do not believe you are improving the breed in that way. We prefer 10 records of 9,000 pounds and 10 calves to perpetuate the good work of that cow to a 30,000-pound record and a dead cow.

In America I have seen some farmers with 15 or 20 cows and they have had records of 8,000 pounds for heifers and 9,500 pounds for mature cows. I have told them, "Oh, that is nothing. So-and-So has cows that average up to 18,000." They have replied, "We are not professionals; we don't go in for making records; we go in for breeding cows, and we sell our cows to these professionals, who, after getting them, are able to more than double the record which we make." You can't expect an animal to make abnormal records and then breed true to it afterwards. [Applause.]

I will cite an instance that occurred during one of our excursions. We had with us a most intelligent gentleman from Japan. It was a great misfortune that he did not know a little more English. However, in discussing these big records at one of your millionaire farms, he said, "In Japan, we have cows that give over 41,000 pounds with a butterfat variant of from 3.5 to 13 per cent." He produced a book in English showing a list of big records and how the checking had been done.

Well, that was rather a knockout blow, but I learned how the record could be made. I believe that these cows can give that quantity of milk if the trainer knows his business, but it is at a tremendous cost—the life or usefulness of the cow. Does she deserve that treatment?

I think it would be a good thing if the thinking men of the colleges and the breeders would put their heads together and consider how far these abnormal records damage the dairy cow, and if an advance registry as is currently conducted is of any real service. They would thereby render valuable service to the dairy industry.

In Scotland, with only 30,000 cows on test, it was felt that we were not getting ahead quickly enough. We have been working out a scheme which is ready for the approval of the development commissioner and the Board of Agriculture for Scotland. We hope that in time, through this scheme, every owner of a dairy cow in Scotland will keep books to see what his cow is actually doing.

In Scotland we have benefited greatly from your work, from the results of your research and experimental work, issued by your

State departments and your Federal department. We have read these with avidity, and I wish personally and on behalf of my country to offer you our sincere thanks.

But we Scotchmen don't need to pray the Highlander's prayer. We remember the many excellent men and women whom we have sent to America as pioneers who helped blaze the trail, the men who by quiet, steady, meritorious labor, have helped make a great nation. We can never forget also that one of your most distinguished administrators, the man who laid the foundation of your agricultural research system, by establishing these State colleges which have done such great work for the world, was a farmer from Scotland, who in the hard conditions which exist there was unable to make a living and coming across to Iowa, made good, entered your House of Representatives and became your great Secretary of Agriculture, a man who was above party politics, whom both the Democrats and the Republicans kept in the position of Secretary of Agriculture. I refer to my fellow-countryman, the late James Wilson. I thank you.

Chairman Hatch. The remaining papers for this session will be read by title.

(Adjournment.)

(Papers read by title):

MILK RECORDING IN SCOTLAND.

William Stevenson, B. Sc., N. D. A., N. D. D., superintendent Scottish Milk Records Association, Ayr, Scotland.

INTRODUCTION.

The systematic recording of the milk yields of individual cows on a public basis is carried on more or less extensively in all progressive dairying countries. The immediate object is to enable the owner of the herd to select, breed, and feed his cows according to actual milk yields.

Milk recording on systematic lines has been carried on in Scotland for over 20 years, and has proved one of the most important means of increasing milk production and improving the quality of milk on the most profitable lines, and of enhancing the commercial value of good-milking animals and their progeny. The object of this paper is to enable a comparison to be made with the milk-recording systems of other countries with a view to general progress.

ORIGIN AND EARLY HISTORY.

Previous to the introduction of milk recording on a public basis, some of the more enterprising dairy farmers kept records of the individual milk yields of their cows privately, for their own use, but the records, being unauthenticated, were not of the same value as records made under the auspices and supervision of a public body. The movement was initiated in Denmark in 1894, and since that date systematic milk recording, on more or less similar lines, has been adopted in other countries, including the British Isles. Of the latter, Scotland was the first to introduce the practice.

The present scheme has developed from the scheme of the Highland and Agricultural Society of Scotland, in 1903, initiated by the late John Speir, Kt. St. O., of Newton, Lanarkshire. The movement was well supported during the first season; 34 herds, comprising 1,342 cows, were tested. But there was a fall in numbers in the following year; only 12 herds, or 389 cows, were recorded.

DEVELOPMENT.

The turning point was reached in 1905, and the history is one of unbroken progress up till 1915, when war conditions in the dairying industry began to be severely felt. In 1915 the number of cows recorded in Scotland was 26,572.

At the end of 1907 the Highland and Agricultural Society considered that milk recording had been firmly established, but were of opinion that the scheme would be extended more rapidly if the work were to a greater extent under the control of the dairy farmers themselves. In 1908 the administration was transferred to a special body termed "the Ayrshire cattle milk records committee." The name of this committee was changed in 1910 to "the Scottish milk records committee," and owners of all recognized dairy breeds in Scotland were represented on this committee.

In 1911 the number of cows tested had increased to 14,000. Milk recording had apparently been adopted as routine on over 300 leading dairy farms; and an appreciable improvement in milk yields in recorded herds had become evident. But the need was felt of more systematic direction and supervision of the recording generally in order to give the public the fullest confidence in the authenticity of the figures.

In 1912, for the first time, a direct money grant was obtained from Government funds. An official superivsor of milk recording was appointed, with the necessary clerical staff; and offices were acquired in Ayr, as the most convenient center of the Scottish dairy farming industry.

The Scottish Milk Records Association, as presently constituted, was created in 1914, in accordance with a scheme approved by the Board of Agriculture for Scotland and the development commission, and an annual grant of £2,000 (gradually increased to £3,500 in 1922) was obtained through the Board of Agriculture for Scotland from the development fund. The authorities had recognized the importance of systematic milk recording from a national standpoint, and the opportunities it offered of improving the dairy breeds and developing the dairying resources of the country. Owners of herds had come to realize also that a good official milk record, beyond suspicion, would in the future enhance more and more the selling value of individual animals and their progeny. A natural progression in the outlook on milk recording was taking place, from records intended mainly for the private use of the herd owners to authenticated milk records that would be accepted without question by the general body of breeders and buyers.

The constitution of the governing body was further extended to comprise representatives for the whole of Scotland, including the three Scottish colleges of agriculture. More complete arrangements were made for the extension, direction, and supervision of milk recording and the revision of the records by the association's staff. From this point onward further improvement in organization, administration, and methods of recording was gradually effected. As a result dairy farmers at home and abroad have shown the greatest confidence in the authenticity of the records, and have readily offered greatly enhanced prices for good animals with good official milk records, or milk record pedigrees.

PRESENT METHOD OF RECORDING.

A distinctive feature of milk recording in Scotland is that the records are entirely the work of trained official recorders. Recorders must first undergo a special course of training in milk recording at an approved college of agriculture. Only candidates of good character and good general education are selected to attend these courses; and all recorders before appointment must be approved by the executive committee of the association.

Dairy farmers taking advantage of the association's scheme are arranged into local milk recording societies. The local society appoints a representative to the membership of the association for each recorder employed. The number of members on a recorder's circuit varies according to the interval between tests; 16 is the full number for tests at intervals of 21 days, including the surprise check tests, or double tests.

The local society applies to the association for license to conduct milk recording under the association's scheme, and must conform to the association's rules and regulations. The local society selects and appoints its recorder or recorders from the list of approved recorders obtained from the association. Apparatus, chemicals, byre sheets, and record books are arranged for by the association, and uniformity of method is assured.

The association allocates grants to local societies on a definite scale as follows: (*a*) The hire of the necessary milk-testing appliances free of annual charge, the local society to maintain the apparatus in good condition; (*b*) an annual grant of 50 shillings to each new member in his first or second year, and of 15 shillings to each member in his third or fourth year; (*c*) an annual grant of 14 shillings per member toward the cost of surprise check tests.

The association also supplies free of charge all byre sheets and record books and, inter alia, regularly supervises the recorders' work and the recording generally, revises and corrects all byre sheets and record books and certifies the records. The annual monetary outlay per member is comparatively small, the average subscription being not more than about £6 per member after the fourth year for an average herd of about 40 cows.

The official recorder visits each herd at irregular intervals, generally from 18 to 23 days. He, or she, arrives at the farm in the afternoon, usually by means of a small pony and trap provided for the purpose, and is accomodated at the farm overnight. All cows in the herd giving milk must be included in the records. Each cow must be clearly distinguished in the byre by a stall number on the wall immediately in front of, and above the level of, the cow, and must also be indelibly tattooed on the ear with distinctive registered tattoo markings. The cows must be milked in the same rotation, evening and morning. The recorder weighs and samples the milk of each cow in the evening, noting the exact time at which each cow is milked. He takes up a position in the byre as near to the milkers as possible, so as to have them in full view, and as far as practicable receives the milk direct from the milker at the cow's side. He again weighs and samples the milk of each cow in a similar manner in the morning. The recorder then tests the mixed evening and morning sample for each cow by the Gerber method for percentage of milk fat. He enters in the byre sheet any unusual conditions likely to affect the milk yields. The recorder is required to see that all milk samples and byre sheets are securely locked up overnight or during his absence.

From the daily results the recorder calculates and completes the byre sheet, multiplying the yields by the exact number of days which have elapsed since the last test, but so calculating throughout that each day of visit is regarded as the middle day of the period covered by the test.

The byre sheets are written out in duplicate; the principal copies are posted at regular intervals to the offices of the association, and the carbon copies left with the respective members. The recorder transfers the results from the extended byre sheet to the milk record book for the herd indelibly in ink, each cow being assigned a separate page, at the top of which full particulars of the cow are entered including the indelible tattoo marks. All byre sheets are carefully revised and corrected in the association's offices and a list of the necessary corrections sent to each recorder.

Visits of inspection are made to each recorder and to the members of local societies at the different farms periodically throughout the year by members of the assocation's staff, and a report thereon submitted to the executive committee. The executive committee reserves the right to withdraw approval of any recorder at any time, or to limit the period of service of any recorder with any particular local society. Members of local societies deemed to be guilty of conduct injurious to milk recording may be temporarily or permanently suspended.

Another distinctive feature in Scotland is the surprise check tests, the records of each herd being checked in this way two or three times in each year. The recorder is instructed by letter or telegram from the superintendent on any date to remain at the same farm another day and make another complete 24 hours' test. The surprise test results are entered on special buff-colored byre sheets, and in the record book in red ink immediately below the results of the test of the previous day. The buff byre sheets are posted to the association's offices with the other byre sheets, and any abnormal difference is immediately noted and reported to the executive committee. As a result of this system of surprise check tests, each page of the milk record book contains two or three lines of entries in red, comparison of which with the immediately preceding entries provides valuable evidence of the genuineness of the milk record.

In addition to the surprise check tests made by the recorder, a number of independent surprise tests are made by the association's staff, in order to check the recorder's work.

The record books are closed at the end of December of each year and new books are opened, current lactations being carried forward to the new books. Summary sheets are written out in duplicate showing the total milk yield for each cow for the lactation or part lactation, with full particulars of the cow, dates of calving, etc. The principal body of the summary sheet is posted to the association's offices with the record book, and the second copy is left with the owner of the herd. All record books and summary sheets are carefully revised, corrected in detail, and initialed in the association's offices, the record books being returned later to the respective members and the summary sheets retained and bound for future reference.

The milk records are next classified into three groups on the following basis. A useful comparison is obtained by reckoning the yields at their estimated equivalent of milk of 1 per cent of milk fat. Such a comparison takes into consideration both the quantity and the quality of the milk. Cows with a milk record equivalent to not less than 25,000 pounds at 1 per cent of fat, and heifers with not less than 20,000 pounds at 1 per cent of fat, are grouped into Class I. Cows and heifers with milk records of less than two-thirds of these quantities, namely, 16,600 and 13,300 pounds respectively, are grouped into Class III. All cows and heifers with milk yields between these limits fall into Class II.

The association publishes an annual report, giving full details of the work of the association and of each milk recording society during the year. From these reports any owner may see how his herd compares with other herds in the same or in any other district, the improvement in his own herd from year to year, and the progress made in the herds of members generally.

An important feature of the association's annual report is the register of good-milking cows, or Class I cows, with the names and addresses of owners and full particulars of the milk records. This register is further restricted to animals which have completed their lactations before the end of the year and given birth to another calf before May 1 of the year following. Full particulars of each record are given. The register is of considerable value to all interested in the breeding and rearing of animals off the best milking strains, and for reference.

EXTENT OF MILK RECORDING.

The following table shows the extent of the development of milk recording in Scotland from the commencement in 1903, as far as numbers are concerned, the effects of war conditions, and the recovery since the cessation of hostilities:

TABLE I.

Year.	Number of of local societies.	Number of of herds tested.	Number of cows and heifers tested.
1903	3	34	1,342
1904	1	12	389
1905	2	30	815
1906	5	76	2,688
1907	7	109	3,931
1908	13	193	8,132
1909	13	212	9,202
1910	13	217	9,514
1911	18	333	13,965
1912	24	438	18,356
1913	32	581	22,816
1914	36	641	26,424
1915	35	642	26,572
1916	28	533	22,702
1917	24	465	19,564
1918	22	426	17,827
1919	25	492	20,172
1920	37	616	26,008
1921	44	670	26,752
1922	40	691	27,634
1923	40	703	28,486

Official recording has become an essential routine in 700 breeding herds in Scotland, and the number is gradually increasing from year to year.

EFFECTS OF MILK RECORDING IN SCOTLAND.

It is quite evident to those familiar with the dairying industry in Scotland that the important objects of the promoters of milk recording are being steadily realized. Good progress has been made in eliminating the poor-milking or unprofitable cows and in increasing the proportion of good-milking cows and the average annual milk yield per cow. A distinct improvement from year to year is also noticeable in the average fat percentage of many of the tested herds.

The following table shows the average annual improvement for all herds tested from 1914 to 1922, inclusive. It should be noted that a considerable proportion of new herds, or herds tested for the first time, were included each year; also, that while the breeds represented include Ayrshires, British Friesians, and a few herds of Jerseys, Shorthorns, Red Polls, and cross cows, the great majority were Ayrshires, the Scottish native dairy breed, and the Ayrshire being a smaller cow requires less food. It is claimed for the Ayrshire cow that she consumes less food relative to milk yield.

TABLE II.

Year.	Total number of cows and heifers tested.	Percentage in Class I.	Percentage in Class III.
1914	26,424	39½	9
1915	26,572	46	6
1916	22,702	53¼	4¾
1917	19,564	50	4¾
1918	17,827	49	5½
1919	20,786	49½	4½
1920	24,191	55¼	3¼
1921	26,752	58¾	4
1922	27,273	63	2

The proportion of good milking cows and heifers to the total animals tested has increased from 39½ per cent in 1914 to 63 per cent in 1922, while the proportion of obviously unprofitable animals has been reduced in the same period from 9 per cent to 2 per cent. This improvement in a total of over 26,000 cows represents a very large increase in the volume of milk produced in recorded herds in Scotland.

Taking the 100 herds with the highest percentage in Class I in 1921, we find that of 2,970 cows and heifers the average proportion in Class I was 92 per cent, and the average proportion in Class III was only 0.6 per cent.

In selecting the 100 best individual cows for season 1921 from the breeder's point of view, or for inherent or hereditary milking properties, attention has been confined to cows which actually produced another calf in not more than 13 months from date of calving preceding opening of record under consideration. The average yield of the 100 selected cows was 12,070 pounds of milk of 3.87 per cent milk fat in 44 weeks. The 100 cows included 75 Ayrshires, 18 British Friesians, 6 cross cows, and 1 Shorthorn.

Improvement from milk recording in Scotland is not confined to the herds actually tested under the scheme of the association. Stocks bulls off heavy-milking strains in the better-known milk record herds have been widely distributed annually among untested herds at home, and a large number have been exported.

INFLUENCE OF MILK RECORDS ON PRICES OF CATTLE.

In recent years milk recording in Scotland has had a remarkable effect on the prices of good milk-record cows and their progeny at both public and private sales. Auction sales of young bulls and other milk-record stock at the instance of well-known breeders have become common when the milk records or the milking pedigrees of the animals are stated in the catalogue of sale. Something still depends upon appearance, but if in addition to good appearance there are also good official milk records for the animals or for the dams or grand dams the prices obtained are almost fabulous compared with prerecord days. Space forbids detailed reference under this heading, but prices as high as 470 guineas, 1,352 guineas, 1,510 guineas, 1,700 guineas, and 1,780 guineas have been paid for young Ayrshire bulls, while whole herds have been disposed of at dispersal sales at average prices far above what could be obtained for ordinary nonrecorded dairy stock.

In view of the great influence of official milk records on the commercial value of dairy animals in recent years the general body of breeders in Scotland concluded that milk records should be taken into account in the judging of dairy cattle at cattle shows. As a result of a mass meeting of breeders and others interested, held in Ayr in 1919, a new standard of judging was agreed to, whereby a maximum of 35 points out of a total maximum of 100 points was to be reserved for allocation according to a definite scale for authenticated milk yields, the only milk yields to be recognized being the official milk records of the Scottish Milk Records Association.

FUTURE DEVELOPMENT.

In a general sense progressive dairy farmers may be divided into two groups:

(1) Those desiring official authenticated records above suspicion, in the first instance to enable them to improve the milking qualities of their herds, but with the further object of establishing the reputation and enhancing the selling value of their stock. These are willing to go to considerable expense and trouble to obtain such records.

(2) Those requiring only private records to enable them to eliminate the poor-milking cows and increase the number of good-milking cows, with a view to the more economical production of milk. The latter prefer a milk record at the minimum of inconvenience and expense. Many of them have only small herds. Many also feel that their cows are not sufficiently good milkers to be included in a scheme of official records.

The association considers that the requirements of both groups could probably be more fully met by a separate system of recording for the owners of unregistered herds who can not see their way to adopt the official system, and are introducing a scheme of private or unofficial milk records whereby the dairy farmer may become his own recorder. It is hoped to bring this new scheme into operation in Scotland in 1924, and that it will establish milk recording on a wider and more popular basis, and ultimately induce a greater number to adopt the official system.

The new scheme is a very simple one. There will be no recorder to accommodate and no form of inspection. The scheme is to apply only to cows and heifers which are not registered by a recognized breed society and to the herds of owners who have not been members of a local milk recording society within a period of five years previous to application. The owner or his agent is to weigh the milk of each cow, evening and next morning, at least once every 21 to 28 days, and to enter the results in a special byre sheet provided by the association. The byre sheet is to be immediately posted to the association's offices to be calculated and extended there, and returned to the owner of the herd. A special private or unofficial record book for each herd will be written out in the association's offices. At the end of each recording season the results will be summarized, and the record books and copies of the summary sheets will be sent to the respective owners of the herds. Each member will be given the use, free of charge, except for upkeep, of a special spring balance and pail, and will be required to pay only a small annual subscription of sixpence per cow toward the clerical work.

The ideal before the association is to have every dairy herd in Scotland included in one or other of the association's two schemes of milk recording.

TASK OF THE GOVERNMENT DAIRY EXPERTS WITH REGARD TO MATTERS OF DAIRYING.

A. J. Swaving, Ph. D., inspector of dairying, chief of dairy division of the general direction of agriculture, Ministry of Home Affairs and of Agriculture, The Hague.

In the Netherlands there are at present ten Government dairy experts and one assistant Government dairy expert with a staff of four head assistants and six assistants. In each Province there is one Government dairy expert or assistant Government dairy expert, however, with the proviso that two Government dairy experts are appointed in the Province of South Holland, whereas in Friesland the organizations interested have a short time ago supplied the want of enlightenment by means of their own staff.

The expert's task comprises: To enlighten associations or private persons at farms and dairy factories concerning butter and cheese making and sometimes concerning cattle breeding; to give instruction at several agricultural winter colleges, at courses for the education of agricultural teachers, at courses in agricultural instructions as well as at a very great number of courses in milk examination, theoretical and practical butter and cheese making, and courses for the education of assistant managers, headmasters of dairy factories, milk controllers, butter and cheese makers; to hold lectures, which are accessible to everyone, free of charge; to give assistance to the preparation and execution of measures or of experiments of general importance (barn competitions, grading of butter and cheese, milking competitions, etc.); to make simple tests concerning dairy products to trace defects of butter and cheese.

Though also at other places, the dairy experts in the Provinces of Utrecht and North Holland and in the eastern part of the Province of South Holland in particular are occupied in giving theoretical and practical instruction in order to improve cheese making and eliminate cheese defects and other working troubles. The instruction of these experts is besides of great use when cheese makers meet with difficulties as to the observance of the regulations of cheese control stations.

The care for the improvement of milk production is considered by the Government dairy experts everywhere most diligently, and they supervise at the same time the work of the breeding and cow testing associations with respect to milk control (milk lists).

In conclusion it may be mentioned that in the interest of mutual contact as well as to remain in touch with the Government one or two meetings are held annually by the dairy experts under the direction of the inspector of dairying of the direction of agriculture. On these occasions different subjects concerning the work and the sphere of activity of the dairy experts are discussed and questions concerning matters of dairying and cattle breeding are looked into.

DAIRY INSTRUCTION GIVEN BY THE COOPERATIVE DAIRY ORGANIZATIONS IN THE NETHERLANDS.

J. A. Geluk, secretary of the General Netherlands Dairy Union, The Hague.

A rather important part of the instruction of the lower staffs of dairy factories in Holland is given by the provincial organizations of cooperative dairy factories and the federation which combines these provincial organizations (eight in number), the General Netherlands Dairy Union.

According to the report in another paper relating to the work of the Government dairy experts, the task of these officials also comprises teaching assistant managers of dairy factories, milk controllers, butter makers, cheese makers, and separator attendants to prepare them for their tasks. The courses of the provisional dairy organizations are held partly in connection with these and partly independent. In so far as the provincial dairy organizations have technical and administrative staffs of their own, which is the case with seven of them, the courses for the lower staffs of the affiliated factories are given by their own functionaries. The lessons in the subjects for which there are no teachers are then, as a rule, given by the Government dairy expert in the Province concerned.

For the education of engineers, courses are also organized by all the provincial organizations of cooperative dairy factories. The lessons are given on the part of the General Netherlands Dairy Union by a teacher-engineer, whose task comprises also advising affiliated factories about engine-room and boiler-house problems.

As a rule, these courses are supervised, as far as the provincial associations are concerned, by a committee appointed for the purpose by the dairy organizations.

In 1908 examinations were instituted by the General Netherlands Dairy Union for the obtainment of certificates for the above-mentioned functions in a dairy factory. Though the courses mentioned are not directly connected with these examinations, that is, following a course is not required for admission to the examinations, it is a fact that the requirements of the examination are dealt with.

The general requirements for admission to the examinations are as follows:

A. PERIOD OF PRACTICAL EMPLOYMENT.

Only those persons are admitted to the examinations who have been employed in practical work during a prescribed period.

It is required that a person who is going in for an examination for:

1. Assistant manager of a butter factory has taken part in the work of one or more steam dairy factories for at least two years.
2. Butter maker has taken part in butter making in one or more steam dairy factories for at least two years.
3. Cheese maker has taken part in cheese making in one or more steam dairy factories for at least two years.
4. Separator attendant has been working in the separator room of one or more steam dairy factories for at least one year.
5. Milk controller has taken part in milk testing in a dairy factory or of a cow-testing association for at least one year.
6. Engineer has been working in the engine room of one or more steam dairy factories, or of a similar concern, for at least three years.

B. PRACTICE CERTIFICATE.

The candidates for the examinations have to produce a testimony that they have given practical evidence of being able to fill the post for which they want to obtain the certificate in an independent manner.

The examining board, in order to obtain a correct judgment of the candidates, is authorized to see them at practical work, if necessary.

For this purpose the latter are registered a year beforehand as far as assistant managers, butter makers, cheese makers, and engineers are concerned; separator attendants and controllers are registered half a year before the examination.

In the meantime the practical ability of the candidates is observed, after which the managers of the factories concerned give a certificate of practical knowledge. The paper is also signed by the person who has observed the candidate on behalf of the examining board.

C. AGE.

Persons submitting themselves to the examination for assistant manager of a butter factory, butter maker, cheese maker, engineer, must be at least 20 years old.

Those who want to submit themselves to the examination for separator attendants, milk controller of a dairy factory, and controller of a cow-testing association must be at least 18 years old.

They must have reached this age on the 1st of April of the year in which the examination is held.

The general program for all certificates runs as follows:

When discussing the different processes belonging to the practice of factory butter and cheese making the candidates must give evidence that they are able to explain the various phenomena involved therein, and they must also give the impression that they can act judiciously.

As a rule the candidates must be acquainted with the appropriate arrangement of the rooms in which they are at work, with the demands made upon the implements and tools used in the factory department in which they are working, as well as how these implements are to be used and cleaned. The candidates must also possess a sufficient general education for the certificate they wish to obtain.

The particular programs for the various certificates are as follows:

1. PROGRAM FOR THE CERTIFICATE OF ASSISTANT MANAGER OF A BUTTER FACTORY.

The examination consists of five parts:

1. Milk and the testing of milk and its products.
2. Separating and Pasteurizing.
3. Butter making.
4. Bookkeeping, dairy organizations, and laws important to the butter maker.
5. Engine room.

I. The candidate must be acquainted with the composition of milk and its particular constituents. He must know the qualities and changes that may occur in milk during the lactation period. He must know the principles of the biology of bacteria and other dairy microorganisms. Furthermore, he must know the significance of microorganisms for butter making (decompositions in milk, cream, and butter, cultivation and elimination).

He must be familiar with all the tests necessary in a modern butter factory and must be able to readily calculate the results of the concern by means of bookkeeping and the tests effected.

The practical skill of the candidates in milk testing is examined previously. In order to be admitted to the further examinations. the candidate must show sufficient skill at this practical examination.

II. The systems of skimming and the difference between centrifugal and natural skimming must be known. The candidate will be examined as to his acquaintance with the purpose and the correct operation of Pasteurizing and refrigerating cream. He must be acquainted with the preparation of starters, the acidification of cream, the treatment of acidified cream, as well as with the mechanism, manipulation, and cleaning of cream Pasteurizers, refrigerators, and cream ripeners.

III. At the examination it must appear that the candidate is acquainted with the purpose and the performance of churning, as well as with the changes going on during the operation of churning and the various factors influencing the result of the churning process. He must appear to understand the various operations taking place after churning (washing, salting, working, packing). He must know the factors influencing the making of a good quality of butter. as well as causes and means of preventing the principal defects of butter. He must know the purpose and the working system of the Dutch butter control and must be able to give a description of the butter-grading competitions as are held by the different organizations.

Finally the candidate must prove that he understands the significance and knows the organization of complete technical bookkeeping in a butter factory.

IV. The candidate must give evidence that he can keep dairy factory books by double entry; he must know the purpose and the nature of the different dairy organizations in the Netherlands (associations of cooperative dairy factories, General Netherlands Dairy Union. butter and cheese control stations, cooperative associations for the sale of dairy products, cooperative dairy banks, etc.); he must know those laws the dairy manager has to do with under normal circumstances.

V. The candidate must be acquainted with the working of the steam boiler (the processes of combustion, feeding the boiler, supplying water, and steam forming) and with the qualities of steam, also with the working of the steam engine and the refrigerator. He must know the principles of electrical light and power plants.

2. PROGRAM FOR THE CERTIFICATE OF BUTTER MAKER.

The examination for the certificate of butter maker consists of the following three parts:

1. Milk and the testing of milk and milk products.
2. Cream.
3. Butter.

I. The candidate must know the composition of milk, some particulars of its constituent parts, as well as its qualities and the changes that may occur in it during the lactation period. He must give evidence to understand the elements of the biology of bacteria (manner of reproduction, conditions for growth) and the significance of the bacteria for butter making (decompositions in milk, cream and butter).

He must be acquainted with the determination of the fat percentage in cream and buttermilk after Gerber; the determinaion of the grade of acidity after Dornic; as well as with the determination of the water percentage in butter.

By means of the result of the milk test he must be able to calculate the butter production.

II. The candidate must know the systems of skimming (centrifugal separation and gravity separation). He will be examined as to his knowledge of the purpose and the correct manner of pasteurizing and cream cooling.

He must be acquainted with the making of starters, the acidification of cream, the treatment of cream during the ripening process, as well as with the mechanism, the treatment and cleaning of cream pasteurizers, coolers, and cream ripeners.

III. At the examination it must appear that the candidate be acquainted with the purpose and the performance of churning as well as with the various factors influencing the result of the churning process. He must appear to understand the various operations taking place after churning (washing, salting, working, packing, attaching the Government mark); he must know the factors upon which the making of a good quality of butter is dependent, as well as the causes and the means of preventing the principal defects of butter (butter-grading competitions).

Finally it must appear that he understands the significance and is acquainted with technical bookkeeping for the butter-making department.

3. PROGRAM FOR THE CERTIFICATE OF CHEESE MAKER.

The examination for the certificate of cheese maker consists of the following two parts:

1. Milk and the testing of milk and milk products.
2. Cheese making.

I. The candidate should know the composition of milk, some particulars concerning its constituents, as well as its qualities and the changes that occur in milk during the lactation period. He must give evidence that he understands the principles of the biology of bacteria (manner of reproduction, conditions for growth) and the significance of the bacteria for cheese making. He must be acquainted with the determination of the fat percentage according to Gerber, as well as with the examination of its qualities (boiling and alcohol test, fermentation, catalase, reductase, and rennet tests, determination of the degree of acidity according to Dornic.)

II. The candidate should be conversant with the treatment and preservation of milk in the cooling room. He must possess a thorough knowledge of the purpose and the operation of the coagulation of milk, the division of the curd, the molding, pressing, salting, and the further treatment and storing of cheese, as well as of the making of the various kinds of cheese in the larger cheese factories in the Netherlands.

He must know the factors upon which the making of a good quality of cheese is dependent, as well as the causes and the means of preventing the principal defects of cheese (cheese-grading competitions).

The candidate must understand the significance and be acquainted with the technical bookkeeping for the cheese-making department.

Finally the candidate must prove that he understands the significance of the cheese control system.

4. PROGRAM FOR THE CERTIFICATE OF SEPARATOR ATTENDANT.

The examination for this certificate consists of the following two parts:

1. Milk and the testing of milk and milk products.
2. Separating and Pasteurizing.

I. The candidate must know the composition of milk, some particulars concerning its constituents, as well as its qualities and the changes which may occur in milk during the lactation period. He must understand the principles of the biology of bacteria (reproduction, conditions for growth, and the significance of bacteria for dairying—decompositions in milk and cream). He must be familiar with the determination of the fat percentage according to Gerber, with the determination of the degree of acidity according to Dornic, as well as with Storch's method.

II. The candidate must understand the working of separators and the circumstances upon which a correct operation of the same is dependent.

At the examination it must appear that the candidate is acquainted with the purpose and the correct operation of forewarming, centrifugal separation, Pasteurizing, and cooling.

5. PROGRAM FOR THE CERTIFICATE OF MILK CONTROLLER IN A DAIRY FACTORY.

The examination for the certificate of milk controller consists of the following two parts:

1. Milk and its testing.
2. Cow-testing association work.

I. At the examination for milk controller the candidates must give evidence of being well acquainted with all the factors to be attended to in taking samples. They must be familiar with the Gerber method for the determination of the fat percentage and the determination of the specific gravity by means of the lactometer. They must know the testing of milk as to its qualities (boiling test, alcohol test, rennet test, acidity, sediment test, fermentation, reductase, and catalase test), as well as the determination of the percentage of moisture in butter.

The candidates, at their own request, may also be admitted to the examination on the fat percentage determination in the dry substance of cheese, and, if their knowledge thereof is sufficient, this is noted on the certificate to be awarded to the candidate.

The candidates at the examination must also show that they have a general notion of milk and its principal constituents; are conversant with the factors influencing the composition and secretion of milk (lactation period, feeding, change of pasture, weather, ruttishness, stabling, markets, age of the cattle, influence of the time and the manner of milking), and must have some notion of milking, treatment of milk, arrangement of a stable, and tending of cattle.

Previously they are examined as to their practical skill in the testing of milk. In order to be admitted to the other examinations the candidates at this practical examination must obtain the qualification "sufficient."

II. The candidates shall be examined as to their general notion of the purpose and usefulness of milk control and their knowledge of the bookkeeping of cow-testing associations.

They must prove to be able to correctly work out records of production.

6. PROGRAM FOR THE CERTIFICATE OF CONTROLLER OF A COW-TESTING ASSOCIATION.

The examination for the certificate of controller consists of two parts:

1. Milk and its testing.
2. Cow testing association work.

1. The candidates for controller of cow-testing associations at the examination must give evidence of knowing well all important factors in taking samples. They must be well trained in the Gerber method for the determination of the percentage of fat in milk and in the determination of the specific gravity by means of the lactometer.

The candidates must also show a general knowledge of milk and its principal constituents, must know the factors influencing the composition and secretion of milk (lactation period, feeding, change of pasture, weather, ruttishness, stabling, marketing, age of the cattle, influence of the time and the manner of milking), must have some notion of milking and the care of milk, and know the arrangement of a stable, and how to care for cattle.

They are previously examined as to their practical skill in milk testing. In order to be admitted to the other examinations the candidate must obtain sufficient points at this practical examination.

II. The candidates shall be examined as to their general notion of the purpose and usefulness of milk control and their knowledge of the bookkeeping of cow-testing associations.

They must be able to correctly work out production records.

7. PROGRAM FOR THE CERTIFICATE OF ENGINEER.

At the examination for engineer of dairy factories the candidates must give evidence of a good understanding of all the factors influencing steam forming and the costs of steam. They must also know the mechanism and working of steam engines and auxiliary engines in dairy factories and be able to indicate how to handle these engines for good and economical working operation.

Moreover the examination must prove that the candidates know the mechanism and operation of the refrigerating machinery in dairy factories as well as how to keep the same in good condition. They must also know the causes influencing the operation of the refrigerating apparatus.

In addition to this they must prove their knowledge of the principles of electrotechnics and be able to work out the calculations necessary to a good understanding of the operations.

In preceding years about 250 persons applied annually for these examinations. From 1908 up to this time 1,133 certificates have been given out.

About the aforementioned technical and administrative functionaries of the provincial dairy organizations, it may be remarked that they virtually have taken over part of the work of the Government dairy experts.

Besides giving lessons at the dairy courses, the task of the technical functionaries is to advise the affiliated factories concerning the best methods of manufacturing their products and to eliminate manufacturing mistakes. Their work, therefore, is closely connected with the periodical examinations of the products from the cooperatively organized factories.

The task of the administrative functionaries is to audit the administrations of those affiliated factories that wish this control, and to advise the factories about bookkeeping in general.

INFORMAL CONFERENCE ON EXTENSION METHODS.

[NOTE.—The late arrival of the trains bringing delegates from the Philadelphia session to Syracuse prevented the speakers of session 8 from attending the session at the time scheduled in the program. However, a few delegates convened in the morning and conducted an informal discussion along the lines of extension education. The report of this conference follows.]

Y. W. C. A. ASSEMBLY HALL,
Syracuse, N. Y., Friday, October 5, 1923—9.30 a. m.

Prof. K. L. Hatch, chairman of session 8, called the meeting to order and made the following address:

To-day is the day of opportunity—to-morrow, the day of hope. To-morrow is also the day of fear, of doubt, of disappointment, perhaps. Extension workers are always working in the day of opportunity. They do not face the morrow because their work is laid out for them. They do well when they meet the problems of the day. Like the famous Light Brigade, it is

> Their's not to reason why—
> Their's but to do and die!

Research workers, on the other hand, always live in the day of hope. By this we mean that research workers furnish the extension service with ammunition for the "charge." In the past, extension workers have seldom questioned the value of their ammunition, but the time is at hand when extension workers will hesitate to use some of the output of research laboratories for extension purposes.

That there is much that is good, valuable, and effective in the archives of research, there can be no doubt. Every speaker on the program this morning will emphasize this point and verify it by many worthy and striking examples; but, shall the extension worker continue to live in the present, satisfied with the material handed to him, or may he project himself into the future sufficiently to anticipate and to avoid the fears, doubts, and disappointment that lie ahead? May he, with propriety, suggest to the research worker the direction that such investigational work may properly take?

It is our belief that experiment station workers must modernize their research, or the extension service, like Othello, will soon find its occupation gone. For 40 years have American experiment stations functioned as national institutions. The value of their contributions has been incalculable. They have done their work well. They are still doing good work. But they have not kept abreast of the changing times. To illustrate: In 1880 we had 4,000,000 American farms containing 200,000,000 acres of improved land. Forty years later the number had increased to 6,500,000, containing 500,000,000 acres of improved land. During the same period the average value of these farms increased from less than $3,000 to over $12,000 each.

The five States near the headwaters of the Mississippi, Iowa, Illinois, Michigan, Minnesota, and Wisconsin, which, with the addition of New York and Pennsylvania, constitute the leading dairy States, contain more than one-fourth of the total agricultural wealth of the Nation. The average value of the farms in these five States has risen in 40 years from $3,000 to nearly $25,000 each. During the same time the average value of the dairy cows has increased from $15 to $70 per head.

These changes are only the effects of the exhaustion of the supply of free land and the consequent increase in value which, at one and the same time, have both promoted the dairy industry and changed it from an empirical occupation to a highly hazardous business. During the same period science has made its invaluable contributions alike to the feeding, care, and management of dairy cattle and to the manufacture, storage, and transportation of dairy products.

All these are excellent building stones for a greater edifice. All are necessary to its successful completion. We still lack the "supreme architect" who will fashion from this excellent material the finished structure, a profitable dairy industry.

WHAT RESEARCH WORKERS ARE NOW DOING.

There has recently come from the pen of a national authority on animal nutrition a little brochure entitled "Recent Discoveries in Stock Feeding." The title is self-explanatory. The subjects discussed are "revised feeding standards," "composition of proteins," "quality of proteins," "mineral requirements of dairy animals," "iodin in the ration," and the interesting, if elusive, "vitamins." Many of the practical bearings of this research which has engrossed the attention of some of the ablest research workers in the center of the dairy world for the past few years are pointed out. These subjects are characteristic of the bulletins published in the past decade by practically every experiment station in the leading dairy States.

And yet, when all this mass of labor and material is digested, it reduces itself to a few recipes. It does not furnish the extension worker with much to do. Somehow it lacks the popular appeal so essential to successful extension work. But what is it that this material lacks?

DAIRYING A BIG BUSINESS.

Dairying is a business, a big and a serious business, both for the producer and the manufacturer.

The dairy farmer is just awakening to the fact that he is a business man employing both capital and labor on no mean scale. Dairy manufacturers are realizing, as never before, that their problem is one of producing an article that will please the trade and stimulate through quality its own demand. These are the big and vital problems that the extension workers must face. They are economic problems and must be faced with facts not now obtainable.

ECONOMIC PROBLEMS MUST BE STUDIED.

Everywhere in experiment station literature we find feed costs of milk production, but rarely do we find labor costs, or dry-cow costs, or depreciated herds costs, or bull costs, or capital charges, such as interest, taxes, insurance, and depreciation, which I submit as the principal costs of milk production on the up-to-date dairy farm. On the manufacturing side we are equally weak. We have not studied the demands of the consumer who makes our market, and consequently have made little effort to produce what will especially appeal to his taste.

And yet every other business of national scope, be it ever so small, has done all these things, and for the most part borne its own costs. A great dairy industry with nationally endowed research laboratories should do these things—must do these same things for the sake of the industry. If the extension service can not do them—as it legally can not—may it not bring to the experiment stations this insistent demand from the field which neither the research nor the extension worker can afford to ignore? If extension work in dairying is to continue to live and grow and function as a great and vital force in the future development of dairying, the economic problems of the dairy industry must yield to solution. If experiment stations in the dairy States rise to their highest opportunity for real service to the industry, they will attack these problems with vigor and push them to successful completion.

In this lies the hope of to-morrow.

Mr. W. S. Kellogg. In my own case I have found the greatest difficulty in securing assistance for various problems that arise. I find that the research workers at State colleges are occupied in their research work, and the extension worker, through the farm bureau in our district, deals with group meetings and problems and classes. The tendency seems to be more toward organization of the poultry and dairy and farming work than the solution of particular problems which arise from time to time.

I have often wondered how that situation could be remedied. Frankly, it would seem if they had a staff that could go about and look into conditions and rectify some of the troubles it would be of very great help. I can easily understand that it would mean a great deal of work and the employment of a great many specialists, yet it seems to me that in some way there ought to be a system devised making it possible to give specific information on different subjects.

Chairman Hatch. Any other remarks?

Professor M. Mortensen (Iowa State College). In our State we have not experienced so much of that difficulty. I happen to be on the other side. I am in dairy manufacturing, but we have a good deal of cooperative work existing between the various departments. In extension service the men have their offices with the departments they represent. So in dairy manufacturing we have three extension men. They have their offices in the dairy building. In dairy husbandry they have two or three men and they work under the animal husbandry department. They have their offices there.

When we have our faculty meetings in our department, our dairy extension men attend whenever they are in. We consider that they belong to the department as members just as much as any of the research or teaching staff. When they suggest work to be taken up from the experiment station side, we take it up as early as possible. We have done some of those practical problems. We figure that the first thing in order now is to bring a better return to the farmers, is to have a better product to market; we must improve the quality and we must standardize the quality. That is what we are working on at the present time.

In our experiment station we carried on some work to determine what kind of butter the consumer wanted. We, of course, know that the quality of the cream must be right in the first place. The second point is, how much acidity do you want? There is a great deal of argument in reference to the amount of flavor that butter must possess. Some claim it should be without flavor and others claim it must have some.

We carried on experimental work along that line by cooperating with commercial judges in New York and Chicago, and from the work done we determined that we must now ripen the cream to acidity determined by multiplying the serum by 0.0063. That is the basis for the work that our men are doing along that line throughout the State.

The work that our manufacturing men are doing along the extension line is to improve the quality. They are scoring cream throughout the various creameries in the State, and in that way they are improving the quality. When we get the quality up to a certain standard then they can apply for what is known as the Iowa State trade-mark that is protected by the State of Iowa by legislation.

We have, at the present time, 20 creameries that are marketing their butter under the Iowa State trade-mark. That is similar to the trade-mark that they have in Denmark. The Holland trade-mark is quite different.

In that way through the extension department there is cooperation. There is the teaching force, the experiment station and the extension department which are practically identical. They are working together as one organization.

It is in that way that the work is carried on through the State, and I can assure you that we have improved the quality of the butter a great deal and we consider that there is no need of trying to establish a marketing organization for our butter before we have the quality of the butter standardized.

Mr. J. V. QUIGLEY (Consumers' League, Kansas City, Mo.). I was glad to hear you say that the extension work should meet the wants of the consumer. That point goes home very well with me because I have been on the three sides—helping the producer and then with the retail distributing company and now with a women's organization of consumers.

After all is said and done, the extent of all your dairying activities depends upon the amount that the consumer will take, and all your talk about the food values will not go home in the way it should unless the consumers believe in the sanitary quality of the product they are getting.

In Kansas City we have a very strong organization that has been working for a period of about 12 years now in helping to improve the quality of the products that go on the market. There are farmers' organizations there that are working with them and employing extension men to help bring their products up.

In that way I think we will expand to a great extent the consumption of dairy products, because, after you have told consumers that the food values of milk are good, and then during a stay in the country they see insanitary dairying, the market sales do not increase.

There is another phase of that. There are problems in the dairy industry that affect the methods of handling the milk on the farm and affect the cattle, problems that deal directly with the quality and not with the production side, that our dairymen around Kansas City are wondering how to solve.

When I left there they were asking, "How can we find out means of decreasing the amount of mastitis in our herds and other udder troubles that are increasing our bacterial troubles, and what are the best methods of holding down bacterial counts in our utensils?"

If a number of things of that sort could be solved in the experiment stations and carried through to the producers of milk through the extension men, they would be of great help to the dairy industry.

Prof. R. C. FISHER (Connecticut Agricultural College). I was interested to hear what Mr. Kellogg had to say. I am connected with the State College at Connecticut, both on the teaching staff and on the experiment station staff; incidentally I am doing some extension work as well, so in many ways I am familiar with the three branches of the educational work.

I quite agree with what our chairman has said in regard to the relation between experiment station and extension work. In many States there is a need of a closer tying up between the work that the experiment station men are doing and the extension men. I have felt that for some time, as a rule, experiment station bulletins are not written for the average farmer because they frequently are expressed in technical terms and in technical language which the average layman does not understand.

However, the extension service or the extension department of a college should take these technical bulletins—and in most cases they are doing this, in Connecticut as well as other States—and digest them and issue popular bulletins which bring out the principal topics of interest to the farmer and as applied to the industry.

As to our organization in Connecticut, we have in many ways the same organization as Professor Mortensen has outlined. We have in the dairy department, at least every two weeks, a conference at which all of our teaching staff, the extension staff, and the experiment station staff are present, and at which we can discuss the problems of dairy extension work, our experiment station work as it is carried on, and our teaching problems.

So we aim, so far as it is possible, to know of each other's work. Those of us who are on the teaching staff try to keep familiar with the extension problems over the State and, similarly, extension men aim to keep in touch with the experiment station work that is under way.

To give an illustration of how we are trying to apply our research work and experiment station work in connection with our dairy extension work, I will mention our present way of trying to improve the quality of the milk. Connecticut, of course, is principally a market milk and ice cream State, market milk especially.

The plan which we have under way at the present time is to go to the smaller milk dealers who have no laboratories and who request our assistance in improving the quality of their milk as it comes in to them from the producers.

To give you a concrete illustration: Last week I was at a dairy that had some trouble with the keeping quality of the milk which the managers were anxious to improve.

We took a bacterial count of every can of milk that came in. Then in the evening, we called in the producers and simply put the facts on the blackboard and pointed out to them that about 80 per cent of them were supplying a fairly good quality of milk, and that only 20 per cent were really causing the trouble. Then we outlined to them how they might improve their quality and perhaps do individual work with the farmers who were having trouble.

After a couple of weeks we usually go back and make another test of the quality of the milk coming in and usually find it improved.

That is the way we are aiming to connect the experiment station work with the extension work. As a matter of fact, I feel that there has been a tendency to separate them too much. There is a certain type of extension work that is almost research work. There is a certain type of research work which can not be done in the laboratory that must be done in the field.

I believe that in certain cases the extension man has to be almost a research man in getting at problems which can not be worked out in the laboratory. I feel that close cooperation is needed.

Chairman Hatch. We are working on the theory that all we need to do is to improve our product and the dairy industry is saved by our extension work. That seems to be the general feeling. I confess that I got the shock of my life from a big distributor not long ago when he said, "I don't know whether we are on the right track or not on this sweet cream butter business. Does the public want it? Do they want it even at the same price, let alone at a premium?" Then he went on and gave me something of the experience of his concern in the matter of handling high quality butter which sold at a few cents' premium above the regular market price. You would soon get a saturated market on that.

Another thing: They are producing what they call "Grade A" milk. He said, "Our customers will take just about so much of that. The average customer for dairy products is just like any other buyer. He wants to buy where he can get it cheapest."

I could not answer that argument.

Our institution has carried on a good deal of extension work on the theory that if we can get the quality up (that is a pronounced quality) and sell it under a trade name and let the public know that it is the best, and give them the taste of it; when they get that taste, they will come back with a repeat order because it is a standard product. Then we will be able to raise this dairy industry out of the slough of despond up into the realm of profit.

It takes money to do that. I admit that we don't know very much about it. I admit that we haven't very much evidence. I don't know what department should handle it in the institution—the department of economics or the department of dairy manufacture, or what—but it is a fertile field for investigation simply because we are basing a large portion of our extension work upon assumption, not on facts.

If we analyze some of our other propositions we will find we will run into a blind alley in about the same way. I really believe that the extension group ought earnestly to discuss these problems with our research workers somewhere in our institutions in order that we may know more than we do about the things which we now assume.

Is there any further discussion?

Professor MORTENSEN. That brings up the other phase of it with reference to cooperation between the various departments in the college.

You made the statement—and I feel the same way—that you did not know whether it was an economics problem or a dairy problem. We have had the same experience. We take it up with those different departments and they cooperate. The matter of marketing the Iowa butter was up for consideration about a year ago. That was considered by the department of economics, by the extension director, and by the department of dairying. We all came together and we talked it over together and we had a definite understanding before we quit.

With reference to sweet cream butter: I don't think you are at all misinformed about that. That has been our experience in Iowa. The consumer does not care so much for sweet cream butter, except in special localities. We want to have sweet cream to start with and ripen it up to the degree of acidity that we believe produces the better result.

Our extension workers have had this satisfaction in working for this State trade-mark, that we can point to all of the creameries that are permitted to use the Iowa State trade-mark to-day, and they have all had an increase in price at from half a cent per pound to 6 cents per pound since they began to use the Iowa State trade-mark.

I consider that those extension men have done work worth while.

Chairman Hatch. The question naturally arises, how long can you keep it up? You have, as I understand it, a certain, select group now that are producing extra quality products. Are you safe in your extension service in going ahead and pushing these until you get all to produce the same grade?

If you do get them all, what assurance have you that you are not going to increase the cost and therefore decrease the profits to your dairymen when they come into that group?

Professor Mortensen. Well, the increased cost will be very small, if any. It is the opinion of the farmers in our State that it does not cost any more to produce sweet cream than it costs to produce sour cream. It is true that delivery will cost somewhat more; we must admit that. If you are satisfied in having deliveries made twice or once a week you will have poor quality, and if you have a poor market you will lose a good deal of money on it.

But with us, there is not a creamery in Iowa to-day, of those that are using the Iowa State trade-mark that would go back to the old system. We withdrew the trade-mark from one of the creameries. and as soon as that happened they called me up to their annual meeting; they wanted to know why, and as soon as it was explained that the quality was not up to standard they fired the butter maker and they have a new one now who is producing State trade-mark butter to-day—in fact, he is one of the prize winners of the State.

So far it has appealed to the people.

The Danes at the present time are manufacturing over 200,000,000 pounds of butter a year from that little country, and it is only one-fourth the size of Iowa. They are manufacturing over 200,000,000 pounds a year. Why have they got a market? Why do we store it in New York City? Because we are getting it at a reasonable figure; but another reason is that the American people are beginning to demand the Danish butter.

We don't want that to take place. American butter for American people, but if we can not make butter up to the standard that people want, the Danish butter, the Holland butter, the Irish butter, the New Zealand butter, the Australian butter, and the Argentine butter will be sold on the American market.

Chairman Hatch. To what extent do you think that the price affects that demand, Mr Mortensen?

Professor Mortensen. To some extent, but the butter dealers will now tell you that there is an actual demand created in this country for Danish butter.

Chairman Hatch. Is there any further discussion?

Mr. R. W. Brown (Manitoba Agricultural College, Canada). I did not hear the chairman's paper, but I take it from the title of the session that your main discussion is on dairy education work, the relation of different departments of the Government or college.

Chairman Hatch. We feel that the pure research in dairying has been well done, but we believe that the various fragments of that research have not been coordinated into an economic unit; and because they have not, that much of our extension work is ineffective on account of the fact that we are always "up against" the insistent demand from the field, "Tell me how to make money out of dairying." That is what our farmers tell us. They say, "You can produce if you want to, but it costs money to produce high quality. Show me how I can make money producing sweet cream. You can have sanitary conditions such as you describe, milk coolers, milk rooms, and handle your herd thus and so, but show me how I can make money out of it."

That is what they are asking us now. We are simply discussing the possibility of getting some answers to some of these economic problems from the research workers.

Mr. BROWN. Then I will say just a word in regard to sweet cream.

We believe that sweet cream is what we want and we want to churn it while it is sweet because the butter keeps better in storage. Eighty per cent of our butter is made during six months in the summer, 20 per cent during the winter six months. That means that a good deal of this butter must be stored for six months or longer and it must have a good keeping quality. If it has not a good keeping quality it can not be sold at any price. If it comes out of storage off-grade, as we call it, there is very little market for it. If it is special or first grade butter then there is a good market for it and people are willing to pay, I believe, a number of cents more for good butter than for butter which they can't use at all.

So we are working toward that, and, I believe, as Professor Mortensen said, it does not cost much more to produce sweet cream than sour or off-grade cream. The thing is to get people to take care of their cream by simple, cheap methods.

With regard to the extension work: Dairy extension has largely been done by the dairy branch with us. A change had been made just before I left. The extension department has moved from the Department of Agriculture back to the agricultural college, where we believe it ought to be. For some years it was directly under the control of the Department of Agriculture and the extension workers have very little connection with the college; in fact, we very often did not know who were on the extension service at all, and there was no satisfactory arrangement. I think that from now on, our extension work will be more effective.

Thank you.

Chairman HATCH. This is everybody's meeting. We can't proceed with the regular program, so we may as well pass the time this way.

Mr. J. S. MOORE (Mississippi). I believe that Professor Mortensen struck the keynote there in cooperation, in the working together of the different forces. This is a big industry and you can't confine the work to the dairy department of the institution; you have to call in other men.

It seems to me one of our weak points is the fact that we have not gone out far enough yet. We have county agents in practically every county in our State, but we have not been able to line them up, as it were, with the dairy work, and if anyone has worked out a system of getting the county agent (of course he has a broad field to cover; he can't be a specialist in dairying) linked up with the dairy extension man, I would like to know about it. Then he should also be linked up with the investigator of the college and with the other forces there at the college.

So I would like to hear a little discussion as to how other States handle that feature in getting this information through your dairy extension agent to your county agent, who, in turn, gets it down to the man that he works with.

We only have, for instance, two dairy extension agents. They can't cover the whole State, but if they could connect up with these county agents and get that before the people, we feel it would help us quite a little bit in getting our research work right to the man who needs it most.

Chairman Hatch. May I ask a question right at that point which is suggested by your remarks ? You spoke of the cooperative movement. We are being drawn into this whirlpool of the cooperative movement in dairy production, dairy marketing, and dairy manufacturing. What assurance have we to give the farmer that five years hence he is going to be better off if he participates in this thing? What do we know about the actual working out of these cooperative units that assures us that the dairy industry will be more profitable to the producer when he has created these organizations of his own? How do we know that they are going to be any more efficient than the present institutions that are set up and are now handling the product?

Mr. Moore. I could not answer that offhand, but taking the economist's view of it, it seems to me that of all the systems that have ever been in practice in any place, the present system, or the past system I will say, that has been adopted in the marketing of all farm products, including dairy products, has been the most wasteful; it is economically unsound. We are simply trying to get on a sound economic basis.

I will use as an illustration an article that perhaps you are not very familiar with, cotton. Cotton has been the great money crop of the South. Cotton has been marketed about like we used to market dairy products. Tom, Dick, and Harry markets his crop. He gets it ready, carries it to the market, and takes what he gets for it, just as we used to carry our butter, as individual farmers, to the market and take anything we could get. The creameries came along, a cooperative movement, whether by individuals or by farmers cooperating together forming a cooperative creamery.

If we can get cooperation still more efficient and have cooperative marketing as they have it, it will help a great deal. Out in the West they have worked out some of those problems to the benefit of the farmer.

So I don't think we need to have any fear as to what will happen if we can get there. The trouble that I see is getting everybody to cooperate. There is our trouble. We have no fear but what cooperation and working together will be more efficient than our present plan. Perhaps we are wrong, but that is the way we feel about it. We feel that we are on safe grounds so far as the cooperative movement is concerned.

Chairman Hatch. I did not mean to question the cooperative idea, but to suggest that we would hesitate to continue on faith and advocate the practices of whose workings we know little. We would not have advocated the application of the serum and virus method for the control of hog cholera without first having fundamental research upon which to base that kind of instruction from our institutions.

I can multiply illustrations, but I don't need to; and yet we do not hesitate in going ahead on some of the philosophy that we are doing now without any more information and without any facts.

I am just wondering if it is not pretty nearly the function of our educational instrumentalities to produce the facts and put them in the hands of the extension workers, so that the extension workers can say, "This and this much do we know," not "Do we believe," but "This much do we know with respect to these things."

That is what I am trying to suggest by this little informal discussion that we have had this morning.

Mr. W. S. KELLOGG (Derby, Conn.) We could accomplish the purpose by the formation of a few local farmers, which would be in the nature of an embryo cooperative society. We can not, it seems to me, figure out the mathematics of the profit in the cooperative movement until it has been experimented with in small units in different parts of the world.

While I am not altogether familiar with it, I believe the cooperative movement in Denmark has practically revolutionized the farming industry. Twenty-five years ago they were in quite bad shape. Through the cooperative movement they are highly prosperous to-day.

However, I know in the Eastern States every farmer is sure that if he ties up with some other small farmer that somebody is going to "do" him. He goes to the nearest village or town and peddles his product from his wagon to the grocer or milkman or restaurant that can buy his stuff.

They are not all people of high moral standards, and they don't give him all they can afford to pay for his product. The result is the farmer is always underselling the market, and his product is very irregular. He brings in "strictly fresh eggs," and they may have been gathered any time within two weeks. He sells them for "strictly fresh," and people who are gathering real strictly fresh eggs are handicapped.

However, they will not get together in a community and take turns coming to town regularly so as to deliver those eggs as strictly fresh, find out what strictly fresh eggs in the market are worth, and sell them for that.

They do the same thing with their milk. In Connecticut we have a milk exchange cooperative association, and yet they can not get farmers of Connecticut to pay the membership dues and join that association. One of the functions of the association is to find a market for their milk at a fair price. They will go out and sell from 3 to 4 cents a quart regularly under the market, and they don't take care of their milk, most of them. The result is there is a low-priced milk being thrown on the market. People buy it, and they complain that the milk is poor.

I should say that more than 50 per cent of the farmers can not be made to see that if they could trust somebody to the extent of maintaining a price, even if they had to hold it a few days until their surplus could be disposed of, that they would benefit.

I think that the preliminary steps must be worked out in the smaller communities in piecemeal before you can establish anything on a general cooperative basis. In that way you can determine whether it is a success or a failure.

Professor Mortensen. I fully agree with Mr. Kellogg about what cooperation has done for the Danes. When I went to school in that country in 1880 it was practically bankrupt. To-day they are living in luxury. Also I think that what Mr. Kellogg has said about the small unit should be emphasized. We have organized a great many cooperative creameries from the Iowa State College, and there has not been a creamery that has failed of those that we have organized; but we have had several farming communities that have come to us about establishing a creamery at a place where we knew that they could not operate cooperative creameries satisfactorily, and we have suggested that they not go ahead, and in one place where they went ahead anyway they have closed to-day.

We have another kind of cooperative organization that they are starting, and I believe you have reference to that, to some extent, in the butter-marketing associations. Denmark has not gone very strong on those. It is understood in this country that the Danish butter is all marketed cooperatively, but it is not so. The Maypole Co., of England, and, I think the Lipton Co. are handling some, and the big cooperative wholesale organizations at Manchester are buying the butter direct from the Danish creameries.

When I was over there in 1914 I talked with a man who was the president of a farmers' college. He told me that he had the biggest cooperative organization, that was made up from 100 creameries. When you talk to the creamery men over there they seem to think that they are not making any more money by selling through the cooperative organization than by selling direct to some of those dealers. Of course, they are somewhat differently situated from what we are, because they have those big dealers in England.

The Maypole Co. is operating over 800 stores in England. The Lipton Co. is operating about the same number. The big cooperative wholesaling organization is selling all of the cooperative stores, practically, in England. They are experimenting now.

We had this same matter up in Iowa with the director of the extension department, the economics department, and the dairy department when they wanted to organize this big cooperative selling organization in the State of Iowa, the same as they wanted to do in Wisconsin and in Minnesota. We felt that as they were going ahead in Minnesota we would prefer to have them go ahead and carry on the experiment. They have now an organization there composed of some 100 creameries, and I understand some of the Wisconsin creameries have joined. I consider that that is our experiment station at the present time on marketing butter in a big way. If that works out, we will follow, but we are not ready to start an organization of that kind until we have some experimental data.

The small organizations do not prove at all whether such a big organization will have stability enough to carry on that sales organization as it should be done.

Chairman **Hatch**. We have been favored this morning with the presence of some ladies, and we would very much like to have them indicate their views on matters under consideration.

Miss **Vera McCrea** (Dairymen's League, New York City). I have been very much interested in this discussion. I would like to say that I think, as extension workers, we sometimes fail to take the time, perhaps, to get over the real purpose of our work. I think sometimes we become so absorbed in finding the bacterial count in milk that we fail to see the real purpose of all the educational work that we are doing.

I think the problem is with us, as everywhere, how to make the consumer understand the value of the higher standards which we are trying to establish with the producer, and I certainly would be very glad to know how that is being worked out in some of the other States.

Chairman **Hatch**. What is your further pleasure?

Professor **Mortensen**. I move that we adjourn.

(Adjournment.)

CONFERENCE ON DAIRY PUBLICATIONS.

Chairman, J. H. **Frandsen**, editor in chief, The Journal of Dairy Science, and dairy editor, Capper Farm Press.

Chamber of Commerce,
Syracuse, N. Y., Friday, October 5, 1923—1.30 p. m.

An informal meeting was called by the chairman for the purpose of devising some method for the systematic exchange of abstracts of scientific work between publications of the United States and those of foreign countries. The discussions centered largely around the methods of preparing abstracts and research papers. Professor Porcher, of France, outlined very completely his idea of the material which should be included in an abstract, and discussed the difficulty encountered by editors of scientific journals in endeavoring to have the papers published in a uniform manner and in limiting them to the necessary length. It often becomes necessary for him to send papers back to the authors with instructions to reduce them to a certain number of pages. He admired the American method of presenting a summary or conclusions at the end of a paper, but cautioned against drawing conclusions that were not justified by the results. He expressed a willingness to exchange abstracts, but desired that they be prepared in the same conscientious manner in which he prepares them. The length of abstracts should, in general, be governed by the importance of the paper. He suggested summarizing the paper in preparing the abstract and then having the abstractor give his personal opinion of the article. The editor, or his collaborators, would prepare the abstract and the editor himself would finally be responsible for the material contained in it.

Those participating in the discussion generally agreed with Professor Porcher's suggestions, but also mentioned some of the difficulties involved in carrying out the suggestions.

The following persons attended the conference: Prof. Dr. Ch. Porcher, editor in chief, Le Lait, Lyons, France; Prof. L. Landre, Syracuse University; Mrs. Moore, National Health Magazine, Chicago, Ill.; A. W. Hopkins, agricultural editor, University of Wisconsin, Madison, Wis.; Prof. R. C. Fisher, Connecticut Agricultural Experiment Station, Storrs, Conn.; C. E. Williams, Williams & Wilkins, publishers, Baltimore, Md.; R. C. Hibben, Ice Cream Trade Journal, New York City; J. H. Frandsen, Journal of Dairy Science and Capper Farm Press, Lincoln, Nebr.; Dr. C. Longobardi, International Institute of Agriculture, Rome, Italy; H. E. O. Heinemann, Creamery and Milk Plant Monthly, Chicago, Ill.; G. Haines, Experiment Station Record, United States Department of Agriculture, Washington, D. C.

SESSION 9. THE NUTRITIONAL VALUE OF MILK.

Honorary chairman, Dr. J. M. HAMILL, medical officer, Ministry of Health, London.

Chairman, Dr. H. S. CUMMING, Surgeon General, United States Public Health Service.

Secretary, GEORGE C. WHITE, professor of dairy husbandry, Connecticut Agricultural College.

FIRST BAPTIST CHURCH AUDITORIUM,
Syracuse, N. Y., Saturday, October 6, 1923—9.30 a. m.

Chairman CUMMING. I am intensely interested in this movement, which is one of the greatest aids to public health, not only in the United States but in the world. While there is a difference of opinion as to just what particular factors improve the public health of the Nation, there is no doubt that food is absolutely essential. The Public Health Service has for many years been studying milk particularly. First we began studying the effect of Pasteurization. Later we began to teach the public of the South to use milk as one of the principal factors in eliminating pellagra. So I am particularly grateful for the opportunity of meeting with you to-day.

I want, first, to introduce the honorary chairman, Dr. J. M. Hamill, of the Public Health Service, of London, who has been carrying on this work for many years. As I recollect, he first began to study the use of bread and later studied milk.

The first speaker to-day is one who hardly needs any introduction here or abroad, Dr. E. V. McCollum, of Johns Hopkins University, I think it is particularly appropriate that he should speak here this morning, because my recollection is that he began his work with the study of the proper food for cattle. Later on, as you know, he took up his work at Johns Hopkins University. [Applause.]

THE NUTRITIONAL VALUE OF MILK.

ELMER VERNER McCOLLUM, Ph. D., Sc. D., professor, School of Hygiene, Johns Hopkins University, with HELEN T. PARSONS and ETHEL KALMBACH collaborating, Baltimore.

In utilizing the results of nutrition studies on animals in interpreting human nutrition problems and their solution, the question of how far the results obtained with animals are applicable to the human being is a serious one. The period of growth in the human species is extraordinarily long as compared with that of the young of any mammals among the lower animals. This long period of youth doubtless is a factor of safety, since the opportunity for recovery from faulty nutrition at any time during early life is relatively great, because of the long time interval during which growth is possible.

We may reasonably set as our standard of optimal well-being in animals, uninterrupted growth to the full adult size, high fertility, low infant mortality, perfection of the bones and teeth, and the ability to resist infections and to reach advanced chronological age before senile characters appear. With such standards as a basis of judgment regarding quality of foods, we are justified in the generalization, on the basis of very numerous experimental results from many sources, that, for domestic animals, such as swine or rats, it is not possible to obtain optimal nutrition on any diet, the selection of which is restricted to cereal grains, such as wheat, corn, rice, etc.; the legume seeds, such as peas and beans; tubers and roots, such as the potato, sweet potato, radish, turnip, beet, and carrot; and muscle meats, such as beefsteak. With any diet, restricted to these sources, in which highly refined cereal products, sugar, molasses, or other nearly pure carbohydrates, find a prominent place, the results to be expected in animal experiments will be less satisfactory than where these manufactured foods are replaced by their equivalent in whole cereals, and other vegetables of the types enumerated.

An inspection of the types of diets on which mankind has long subsisted in various parts of the world seems to justify laying special emphasis upon two types of human dietaries. One is employed by approximately half of the human race in the wettest parts of the world, where rice is the cereal grain and where, owing to the great density of human population, animal industry can scarcely be said to exist. I refer to southern and eastern Asia. Here the diet differs from the typical American diet of the present day mainly in two respects. These people never had in historical times appreciable amounts of dairy products. They do, however, eat very large amounts, as compared with the people of the United States, of that class of vegetables of which the leaves are eatable. The other type of diet referred to is that of people in the more arid regions of the world where farming yields little return, but where human beings can subsist in great measure through conversion of the pasturage into human food through the agency of domestic animals. Such people subsist in great measure upon sour milk, curds, butter, and meat, with moderate amounts of vegetable food. In both of these regions physical perfection appears to be distinctly greater than that which is achieved by people in the United States of the present generation.

Animal experimental studies have shown that milk and leaves of plants occupy a unique position among our available foodstuffs, in that they are so constituted as to correct, when suitable amounts are included in the diet, the defects of cereals, tubers, roots, and meats. For this reason it was suggested five years ago that they be distinguished by the term "protective foods."

It is unnecessary to dwell upon the specific nature of the deficiencies of each of our more important natural foods, but it may be said that in general there is a marked tendency of the diet of the average American of to-day to be deficient in the element calcium, to be somewhat overrich in phosphorus in proportion to the amount of calcium it contains, to be deficient in the vitamin A, and in some cases in the vitamin C, as well as the antirachitic principle associated with certain fats, the vitamin D. Numerous experimental studies with animals have established the remarkable value as supplementary foods of either milk or leaves. This is one of the well-established facts in animal husbandry.

With such information available we sought five years ago an opportunity to test on human beings how far the principles established in animal experiments would apply to the nutrition of children. With that end in view, we visited a considerable number of institutions where young children were being cared for, in order to discover if possible a group of children who, because of poverty or lack of knowledge on the part of those responsible for their care, were being fed a diet which I suspected to be inadequate for the promotion of growth or the maintenance of well-being. This search was rewarded by the discovery of an institution in which there were 236 negro children ranging in age from early infancy to 12 years, whose environment and food supply left little to be desired in relation to our objective. They were housed in a building of as good construction as one could desire. It was well ventilated, had good toilet facilities, sun porches where the children were instructed in bad weather, and about 10 acres of ground, partly woodland, where they could play out of doors in pleasant weather. Those in charge of the institution had the best possible attitude toward the welfare of the children, but the financial resources of the institution were meager. A casual inspection of the children in this orphanage showed that severe malnutrition existed in most of them. It appeared that if these children were actually suffering from malnutrition, the cause was probably due to the quality of their diet. Accordingly an opportunity was sought to improve the quality of the diet of these children in order to observe the extent to which they would respond in growth and well-being. Happily this opportunity was granted, and a demonstration was undertaken with such funds as could be secured.

On ethical grounds it is not permissible deliberately to subject children to diets whose quality is suspected of being unsatisfactory, but it is not only permissible but commendable to improve the dietary of children who are, for reasons of poverty or lack of knowledge, being subjected to conditions inimical to their development. The demonstration which it was desired to make involved a considerable expenditure of funds. It was also desirable not to interfere to any considerable extent with the daily routine of the institution. These were both factors of great importance in determining upon the measures which should be taken to gain the information desired.

In 1919, 84 children between the ages of 4 and 10 years were selected for the study. The only basis of rejection was the obvious presence of syphilis. A considerable number of the children were believed to be tubercular. Many showed deformities characteristic of rickets. Since it was of the utmost importance to interfere with the daily routine of the institution as little as possible, and because of inadequate facilities in the kitchen, it was deemed inadvisable to attempt any additional cookery in connection with the demonstration.

These 84 children were weighed, measured, and photographed without their clothing. Their ages were in practically all cases accurately known. This examination confirmed the conclusion that malnutrition of severe grade was widespread among the children.

A study of the dietary of the institution over a few weeks revealed the fact that it consisted essentially of a soup made of a fairly wide variety of foodstuffs, together with all the bread which the children cared to eat. Cereal was frequently served for breakfast. In Table I the food supply over an interval of one week is given in detail. This is fairly typical of the period covered by this study. All the components of the diet except the bread and some cereal and fruit were incorporated into the soup. The soup was palatable and attractive and was believed to possess a high food value. Actually from the standard of calories and proteins it left little to be desired. During the demonstration 4 to 5 per cent of the total calories of the diet was supplied in the form of meat, which was included in the soup, and went far toward adding to its attractiveness.

Here we had a dietary for children during the period when growth should be proceeding at a rapid rate which consisted essentially of cereals, tubers, fleshy roots, and muscle meats, and a considerable portion of the total food supply was furnished in the form of a refined wheat flour in the form of white bread. Since the diet of bread and soup such as has been described contains no fresh raw food, the question at once arose why scurvy had not appeared among the children. None showed any scorbutic tendencies, and the attending physician assured us that this had not been a problem in the institution. The cause of this immunity to scurvy was soon discovered. Certain fruit vendors in near-by markets regularly donated lemons which were still sound but were likely to spoil before the next market day. It had been the custom to slice these lemons and give each child a slice. This one raw fruit was highly appreciated by the children and served as their source of the vitamin C.

The simplest procedure for improving the quality of this diet without involving any additional cookery appeared to be the addition of milk. This plan was adopted. Accordingly one group of 42 children received 1 quart of whole milk each per day during the demonstration period. This was prepared from Merrell-Soule's whole milk powder (Klim). It was prepared by dissolving the proper amounts of whole milk powder in cold water and agitating in a mechanical mixer. Only in very cold weather was the water warmed to some extent. The other group, which we designated as the check group, was continued on the institutional diet. We were thus in a position to compare the children on the two dietaries, since every effort was made in dividing the 84 children into two groups of 42 each to pair them so that any child in one group was quite comparable in age, size, and condition to a child in the other group.

It is to be expected in any demonstration of this kind, where tubercular children, and children who had suffered from faulty skeletal development to a pronounced degree, were included, that certain individuals would be less capable of responding with growth to an improved dietary than would others. The accompanying charts give an accurate idea as to the general results of the comparison.

One of the striking features of the records of all children of both groups is the sharp increase in body weight, and at a more rapid rate than normal, in the first four to six weeks they were under observation. This happened to both the milk-fed and check groups on the institutional diet. We can not determine with certainty the cause of this sharp increase in weight in both groups, but the most plausible explanation would seem to be the fact that our critical observation of the institution led to a certain increase in the total quantity of food provided to all the children of the institution just at this time. There is strong reason to believe that before our advent the children were being fed not only a diet which was deficient in quality but likewise deficient in amount, so that their condition represented not only the results of malnutrition from a diet of faulty quality but the complication of partial inanition as well.

In the case of the check group, where the quality of the food remained essentially constant before and during the demonstration, the sharp increase in weight of 2 to 5 pounds was not continued. The weight curves of the children of this group suddenly flattened, and in practically all cases they remained nearly or quite stationary. In several there was a gradual loss in weight during the first 12 to 15 months of the demonstration. There was only one child in the check group which made any appreciable gain during the first 15 months of the demonstration.

The milk-fed group showed marked contrast with the check group in several respects. In the first place, the sharp rise in body weight which was observed in both groups during the first few weeks was continued in most children throughout the demonstration, which for a considerable number of children covered a period of 21 months. One child of 5 years, who weighed but 28 pounds in the beginning, increased its body weight by 70 per cent at the end of eight months on the milk, 90 per cent at the end of the first year, and reached a weight which was somewhat over the normal curve as given by the Holt, Boas, and Burke table. Several of the children increased 50 per cent or more in weight during the first year.

There was likewise a marked change in the behavior of the milk-fed group as contrasted with the check group. The latter were apathetic and very tractable. The discipline of the institution was strict and these children were all quite obedient. Those in the milk-fed group, on the other hand, soon caused annoyance to their teachers by their restlessness and desire for activity. They also were frequently guilty of infractions of the rules.

The results of the supplementing of the institutional diet with milk were so striking that after 15 months it was decided to supplement the diet of the check group with a quart of reconstituted milk per day, in order to demonstrate whether these children, at least a considerable number, possessed the capacity to grow which they were not manifesting on the institutional diet. As was anticipated, during the next six months a considerable number of the check group grew at rates comparable to what had been observed in the original milk group.

All things considered, the results of this demonstration constituted, we believe, a most satisfactory demonstration of the validity of the view that a dietary selected from cereals, tubers, fleshy roots, and meat does not prove satisfactory for the physical development of young children. It shows further that milk is as effective a supplementary food for such a type of diet as has been repeatedly shown to be the case with experimental animals.

In making up these tables I selected three periods (two of two weeks each and one of one week) and gave the diet for the milk group and the diet of one of the check groups only. In the last set of tables I selected a period when supplementary feeding (sirup, sugar, and bread) was being given to the check group.

TABLE I.

(a) MILK GROUP.

[Diet for two weeks; 40 children.]

Food.	Weight.		Calories.	Food.	Weight.		Calories.
	Lbs.	*oz.*			*Lbs.*	*oz.*	
Hominy	4	12	7,638.0	Squash	2	1	443.4
Rice		10	944.0	Kohl-rabi	1	5	190.3
Barley	21	0	33,810.0	Preserves	12	0	19,020.0
Flour	1	12	2,805.4	Apples	5	0	1,070.0
Cornstarch	2	0	3 264.0	Bananas	3	12	1,675.8
Corn meal	6	4	10,081.2	Condensed milk		4⅔	448.0
Green corn	1	1	487.7	Fat	2	0	6,820.0
Oatmeal	35	0	63,105.0	Sugar		9⅓	1,029.4
Bread	245	9	288,290.6	Whole milk (dried)	1,190	0	....
Dried beans	5	2	8,015.4				
Salt mackerel	3	6	4,698.0				
Beef	49	5	34,962.5	Total calories from institutional diet			532,191.2
Ham	5	2	6,565.2				
Pork		5	478.0				
Potatoes	80	3	30,310.8	Calories from institutional diet per day per child			950.30
String beans	11	7	2,161.6				
Carrots	5	1	1,037.8	Milk calories per child per day			580.24
Onions	4	6½	969.7				
Turnips	1	15	347.0				
Beets	4	7	927.7	Calories per child per day			1 530.54
Cabbage	3	13	544.7				

(b) INSTITUTIONAL DIET.

[Diet for two weeks; 92 children.]

Food.	Weight.		Calories.	Food.	Weight.		Calories.
	Lbs.	*oz.*			*Lbs.*	*oz.*	
Barley	8	12	14,087.2	Tomatoes	5	9	573.5
Green corn	5	9	2,553.3	Eggplant	2	6	308.6
Oatmeal	70	0	126,210.0	Squash	2	10	564.0
Bread	1,165	0	1,367,710.0	Kohl-rabi	2	8	362.48
Dried beans	2	13	4,398.1	Cheese	1	14	3,738.4
Beef	56	11	40,191.3	Condensed milk		9⅓	896.0
Potatoes	1	11	637.6	Preserves	24	0	38,040.0
String beans	19	9	3,697.2	Apples	34	8	7,383.2
Beets	8	0	1,672.0	Sugar		21	2,316.3
Carrots	4	5	884.0				
Onions	3	3	701.4	Total			1,617,789.28
Turnips	1	3	212.6	Calories per day per child			1,256.04
Cabbage	4	9	652.1				

Table II.

(a) MILK GROUP.

[Diet for two weeks; 40 children.]

Food.	Weight.		Calories.	Food.	Weight.		Calories.
	Lbs.	oz.			Lbs.	oz.	
Hominy	6	8	10,452.5	Eggplant	3	10	471.0
Rice	9	5	14,816.0	Preserves	12	0	19,020.0
Barley	17	7	28,074.2	Condensed milk		11⅓	1,088.0
Flour	4	0	6,412.0	Whole milk (dried)	140	0	....
Noodles	1	8	2,497.0	Fat	2	3	7,459.3
Corn meal	4	4	6,855.2	Sugar		9⅓	1,029.4
Corn	1	11	774.7	Herbs		3⅓	....
Oatmeal	34	4	61,752.4	Salt	....		....
Bread	242	2	284,254.8				
Beef	69	14	49,541.2	Total calories from institutional diet	....		521,014.58
Wieners	1	8	1,701.2				
Potatoes	50	4	18,994.4				
String beans	10	3	1,925.4	Calories from institutional diet per day per child	....		930.38
Green peas	1	3	538.9				
Carrots	3	7	704.6	Milk calories per child per day	....		580.24
Onions	5	6	1,182.8				
Turnips	2	8	447.6				
Cabbage	3	15	562.5	Calories per child per day	....		1,510.62
Celery	2	15	245.0				
Kohl-rabi	1	8	217.48				

(b) INSTITUTIONAL DIET.

[Diet for two weeks; 92 children.]

Food.	Weight.		Calories.	Food.	Weight.		Calories
	Lbs.	oz.			Lbs.	oz.	
Hominy		8	804.5	Onions	3	14	853.2
Rice	1	0	1,591.0	Turnips	1	14	335.8
Barley	12	9	20,225.4	Cabbage	12	9	1,796.1
Flour	2	8	4,007.6	Eggplant	5	11	739.1
Oatmeal	69	8	125,307.8	Squash		12	160.8
Bread	1,312	0	1,540,288.0	Preserves	24	0	38,040.0
Green corn		14	401.8	Condensed milk		18⅔	1,792.0
Dried beans	1	0	1,564.0	Dripping		3	639.3
Fish	10	0	13,920.0	Sugar		14	1,544.2
Beef	60	14	43,160.2				
Potatoes	12	11	4,795.6	Total	....		1,806,075.6
String beans	18	10	3,520.0	Calories per day per child	....		1,402.23
Carrots	2	14	389.2				

TABLE III.

(a) MILK GROUP.

[Diet for one week; 39 children.]

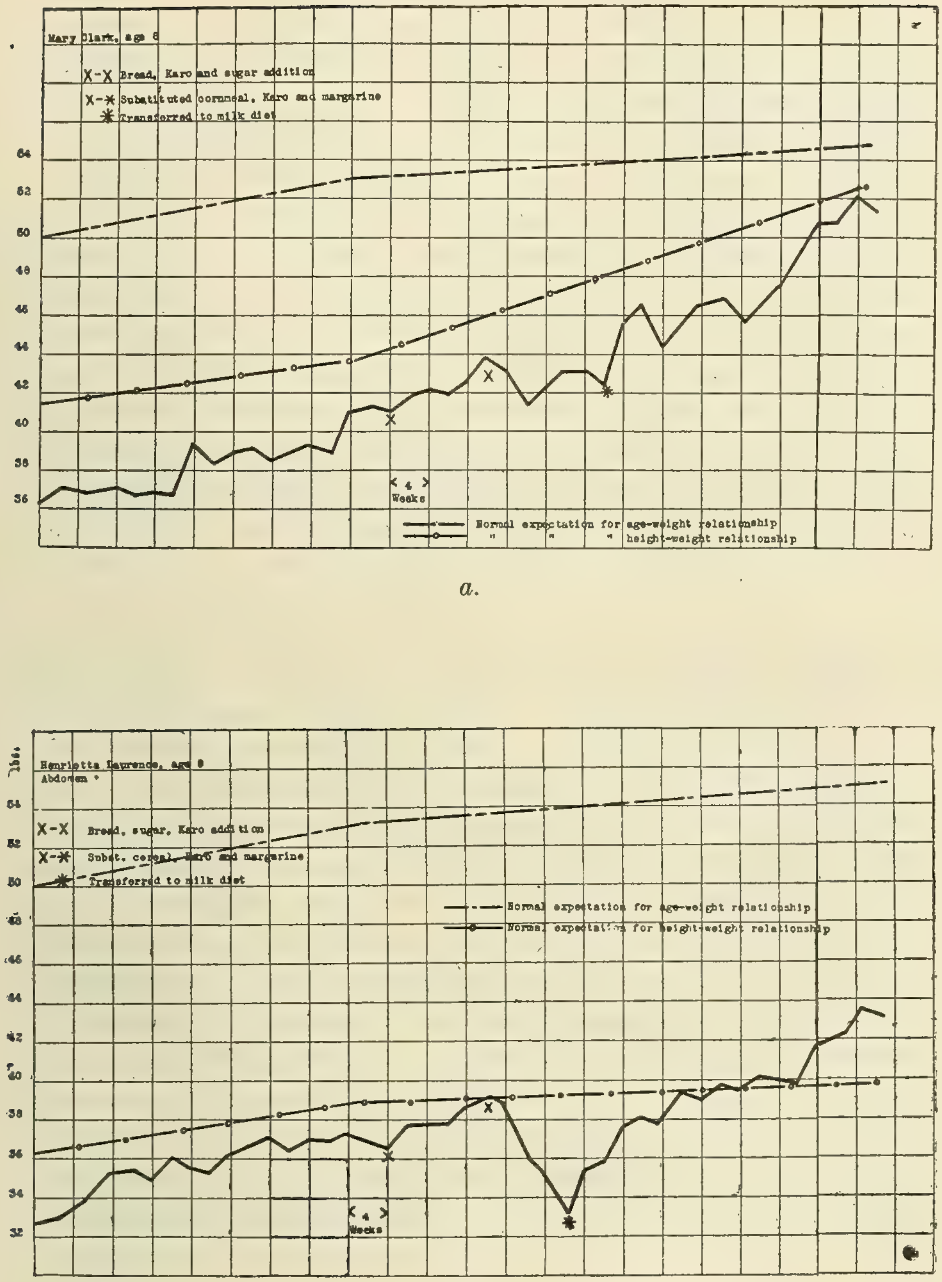
Food.	Weight.		Calories.	Food.	Weight.		Calories.
	Lbs.	*oz.*			*Lbs.*	*oz.*	
Hominy	3	0	4,824.0	Smoked cod	2	4	812.4
Rice	6	2	9,744.8	Sweet potatoes	3	12	2,092.8
Barley	2	12	4,427.2	Preserves	6	0	9,510.0
Flour		12	1,177.2	Bananas	4	14	2,178.6
Macaroni		8	812.0	Condensed milk		9⅓	896.0
Oatmeal	11	0	19,833.0	Whole milk	595	0	....
Cornstarch	1	0	1,632.0	Fat	1	4	4,262.4
Corn meal	8	14	14,315.2	Sugar		5⅓	588.2
Bread	136	14	160,691.6	Salt		3	....
Dried peas		12	1,208.4	Parsley	....		....
Liver		8	269.6				
Pig tail		4	724.8				
Veal	2	15	1,654.0	Total calories from institutional diet	....		256,801.7
Beef	12	1	8,552.3				
Potatoes	5	6	2,031.6				
Carrots	3	1	627.8	Calories from institutional diet per day per child	....		940.6
Rutabaga		15	177.0				
Turnips	5	14	1,051.8	Milk calories per child per day	....		580.24
Parsnips	4	2	1,237.4				
Onions	2	0	440.0				
Celery	1	10	136.0	Calories per child per day	....		1,520.84
Cabbage	6	4	893.6				

(b) INSTITUTIONAL DIET.

[Diet for one week; 93 children.]

Food.	Weight.		Calories.	Food.	Weight.		Calories.
	Lbs.	*oz.*			*Lbs.*	*oz.*	
Hominy	10	0	16,080.0	Cabbage	2	11	383.9
Rice	2	0	3,182.0	Celery		10	52.0
Barley	5	0	8,050.0	Eggplant		12	97.2
Macaroni	1	2	1,827.0	Salt mackerel	15	0	20,880.0
Oatmeal	16	8	29,748.8	Sweet potatoes	17	14	9,974.6
Corn meal	14	0	22,582.0	Preserves	12	0	19,020.0
Dried peas	1	8	589,641.6	Bananas	11	10	5,196.0
Bread	502	4	2,417.6	Apples	6	8	1,391.2
Lima beans	2	8	3,964.8	Condensed milk	12	13	19,680.0
Kidney		9	183.6	Fat		½	106.5
Liver	4	10	2,489.0	Sugar		7	793.8
Ear (as tripe)		10	163.0	Salt		0	....
Heart	3	13	5,032.5	Parsley		3	....
Beef	36	0	22,524.0				
Bologna		12	850.8	Total	....		820,422.6
Bacon		12	1,947.6				
Wieners	5	0	5,760.0	Calories per day per child from institutional diet	....		1,260.2
Corn beef	7	2	9,055.8				
Potatoes	5	6	2,031.6	Supplementary feeding:			
Dried beans	1	8	2,345.6	Sirup	....		17,466.66
Dried lima beans	2	8	3,964.8	Sugar	....		4,626.72
Carrots	4	0	820.0	Bread	....		38,021.2
Turnips	16	1	2,875.2				
Salsify	1	11	....	Total	....		60,114.58
Parsnips	14	13	4,443.1				
Onions	3	15	867.0	Total calories per day per child	....		1,492.3

Original check group.

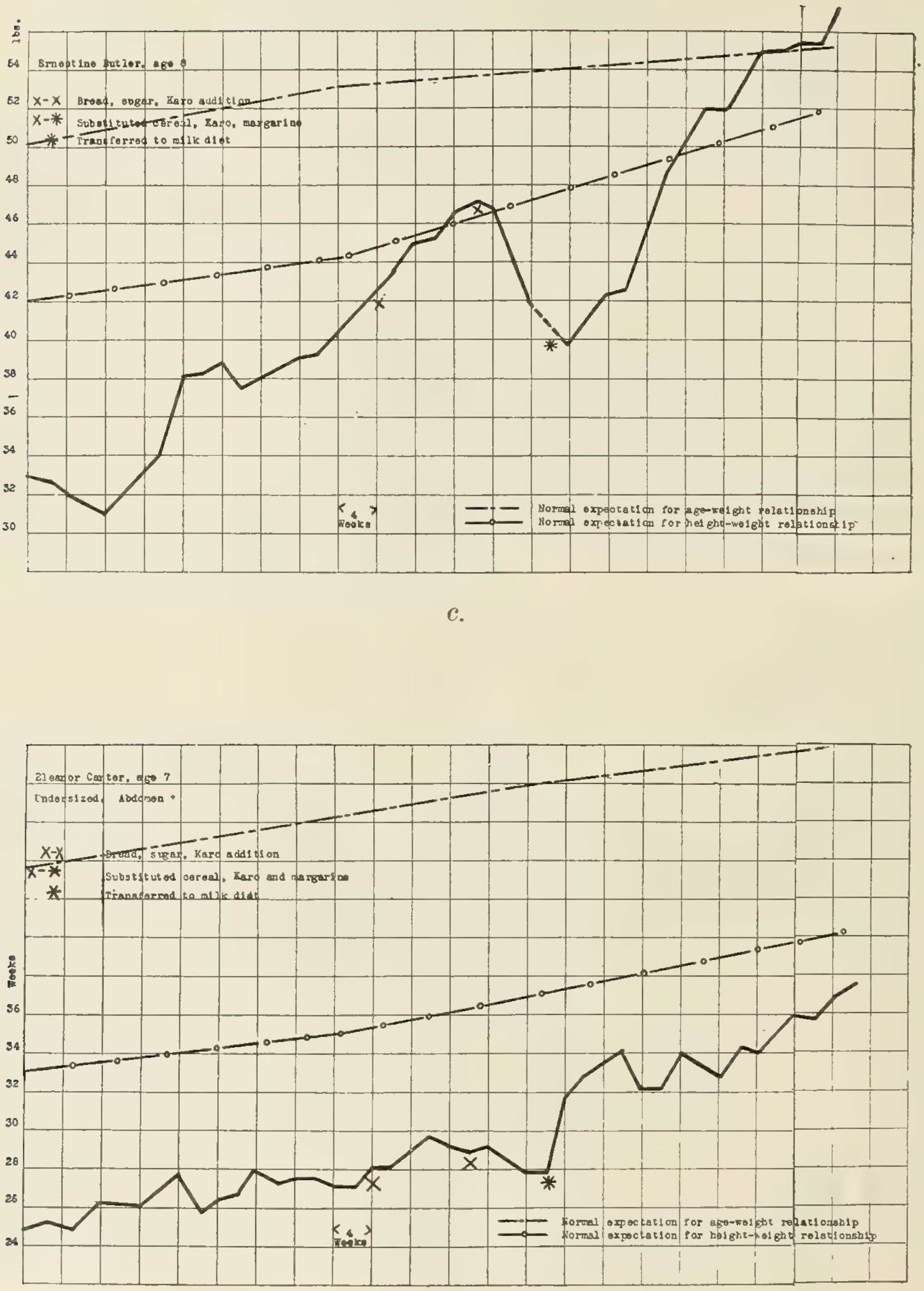


a.

b.

FIG. 1.—*a–b*. Original check group.—Received institutional diet plus supplementary feeding (for calories), but gained little or nothing until milk was added, when they shot up. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve. * Transferred to milk diet.

Original check group—Continued.

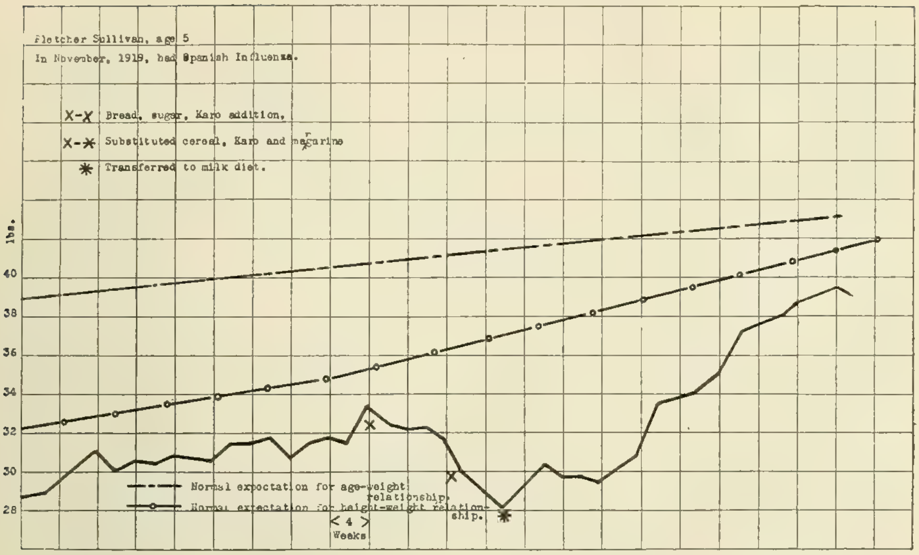


c.

d.

FIG. 1.—*c–d.* Original check group.—Received institutional diet plus supplementary feeding (for calories), but gained little or nothing until milk was added, when they shot up. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve. * Transferred to milk diet.

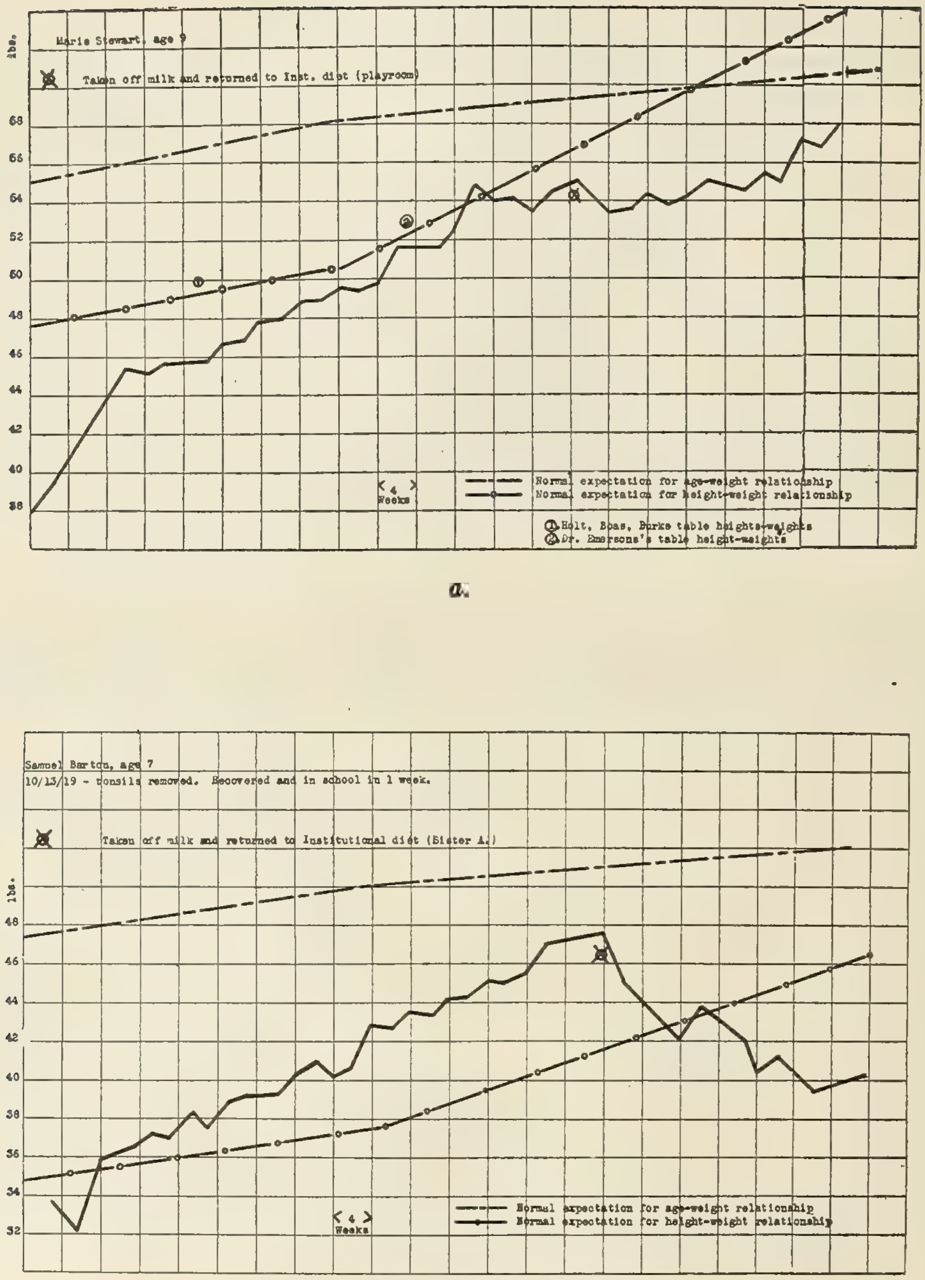
Original check group—Continued.



e.

FIG. 1.—*e.* Original check group.—Received institutional diet plus supplementary feeding (for calories), but gained little or nothing until milk was added, when they shot up. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve. * Transferred to milk diet.

Original milk group.

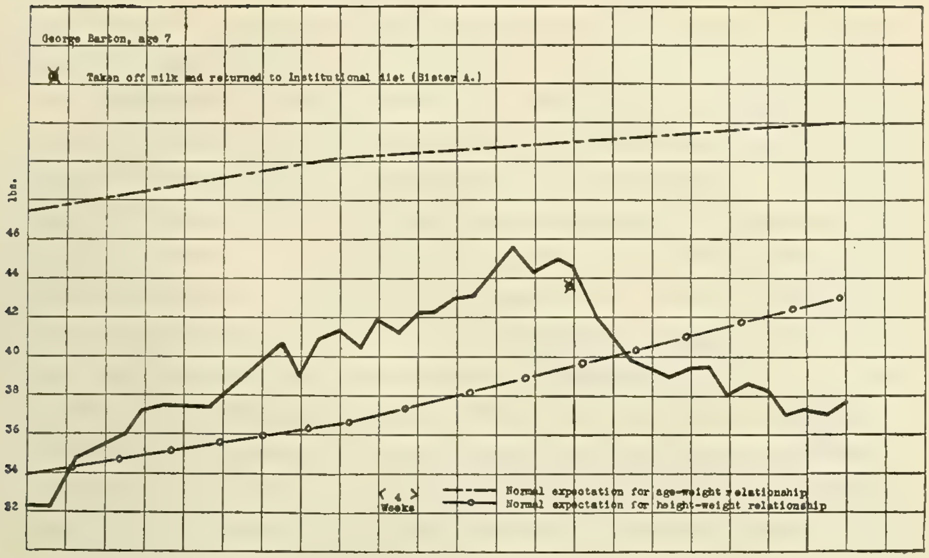


a.

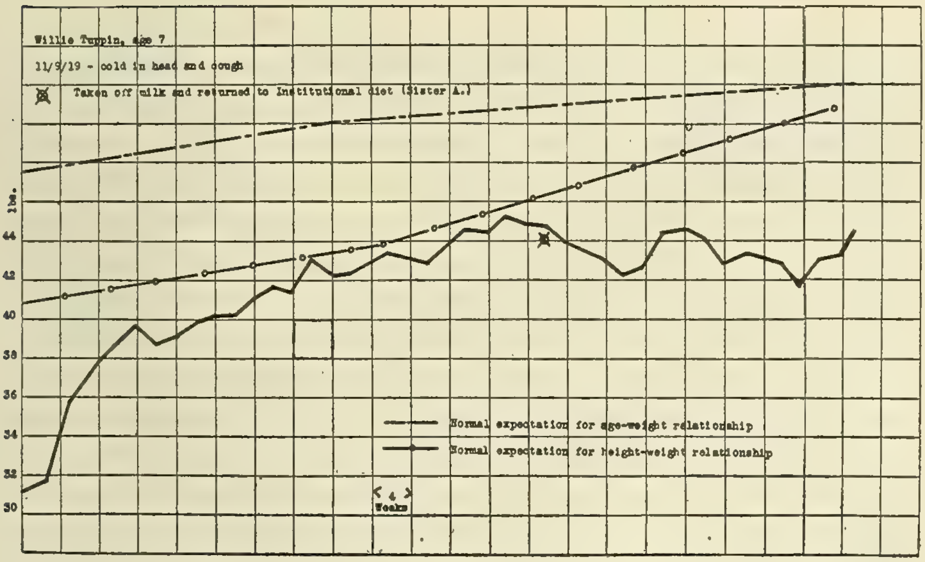
b.

FIG. 2.—*a–b.* Original milk group.—On milk diet for some months. When taken off milk diet and put on institutional diet, either lost weight, failed to gain, or gained but little. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve. * Taken off milk diet.

Original milk group—Continued.



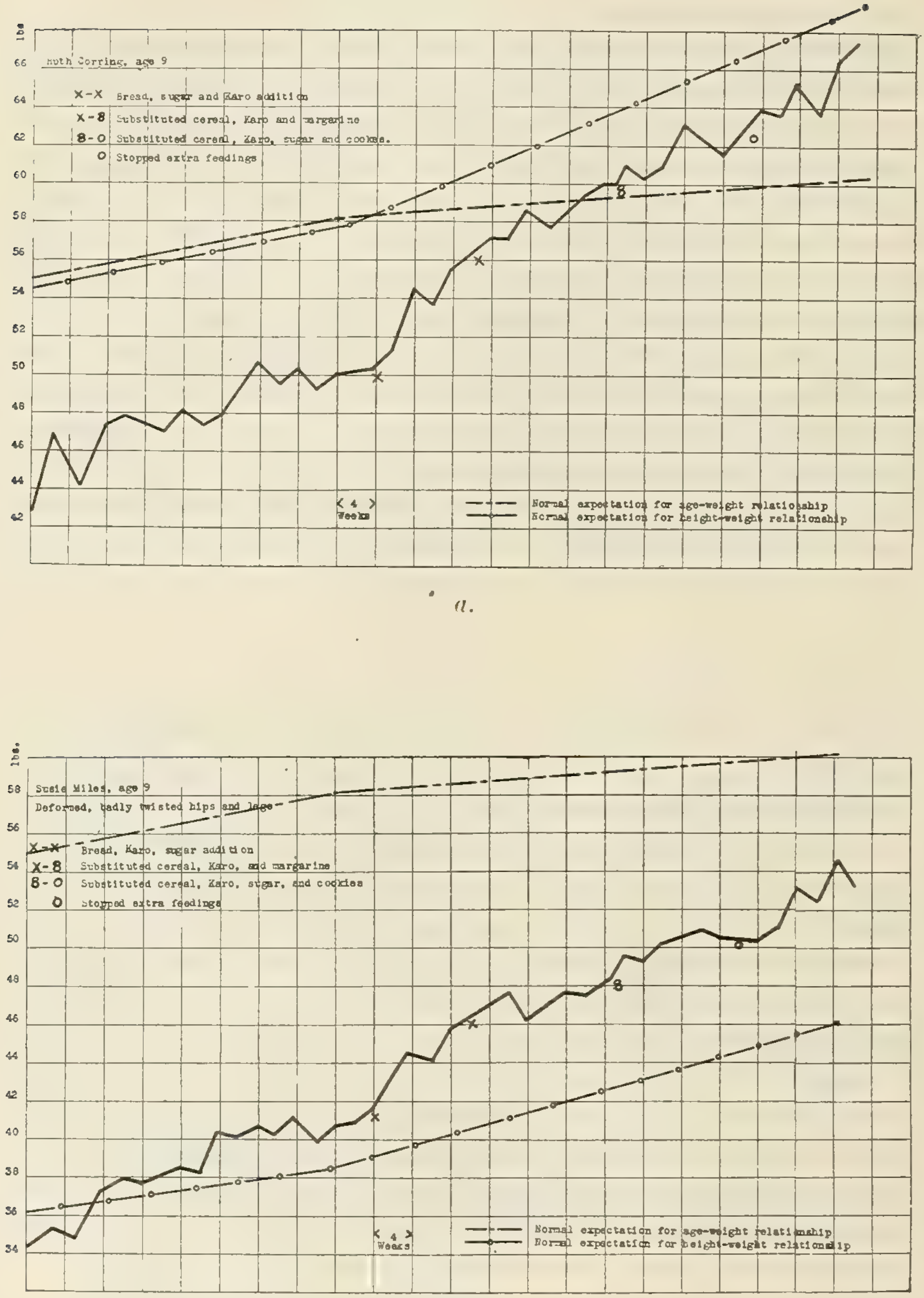
c.



d.

FIG. 2.—*c–d.* Original milk group.—On milk diet for some months. When taken off milk diet and put on institutional diet, either lost weight, failed to gain, or gained but little. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve. * Taken off milk diet.

Original check group.

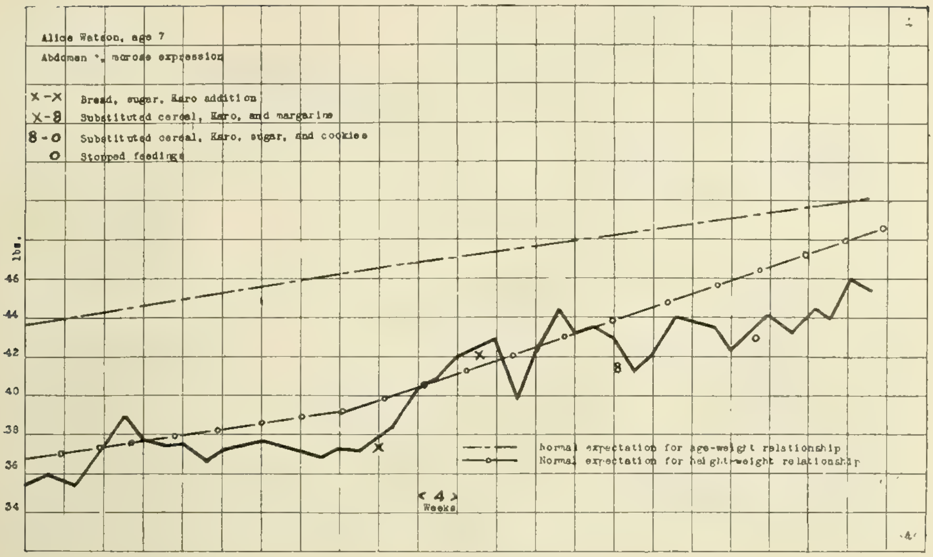


a.

b.

FIG. 3.—*a–b.* Original check group.—Received institutional diet plus supplementary feeding, and gained. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve.

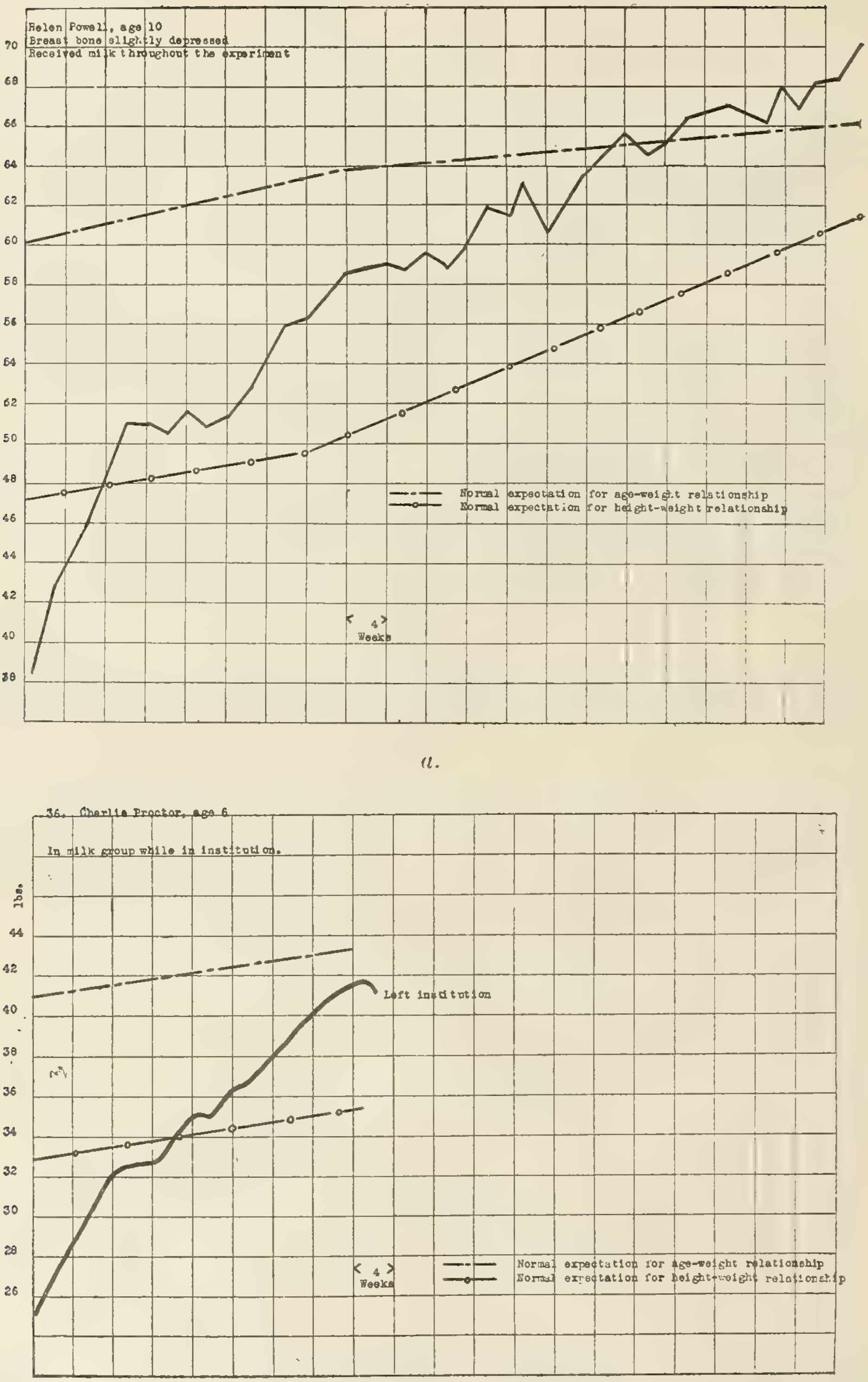
Original check group—Continued.



c.

FIG. 3.—*c*. Original check group.—Received institutional diet plus supplementary feeding, and gained. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve.

Original milk group.

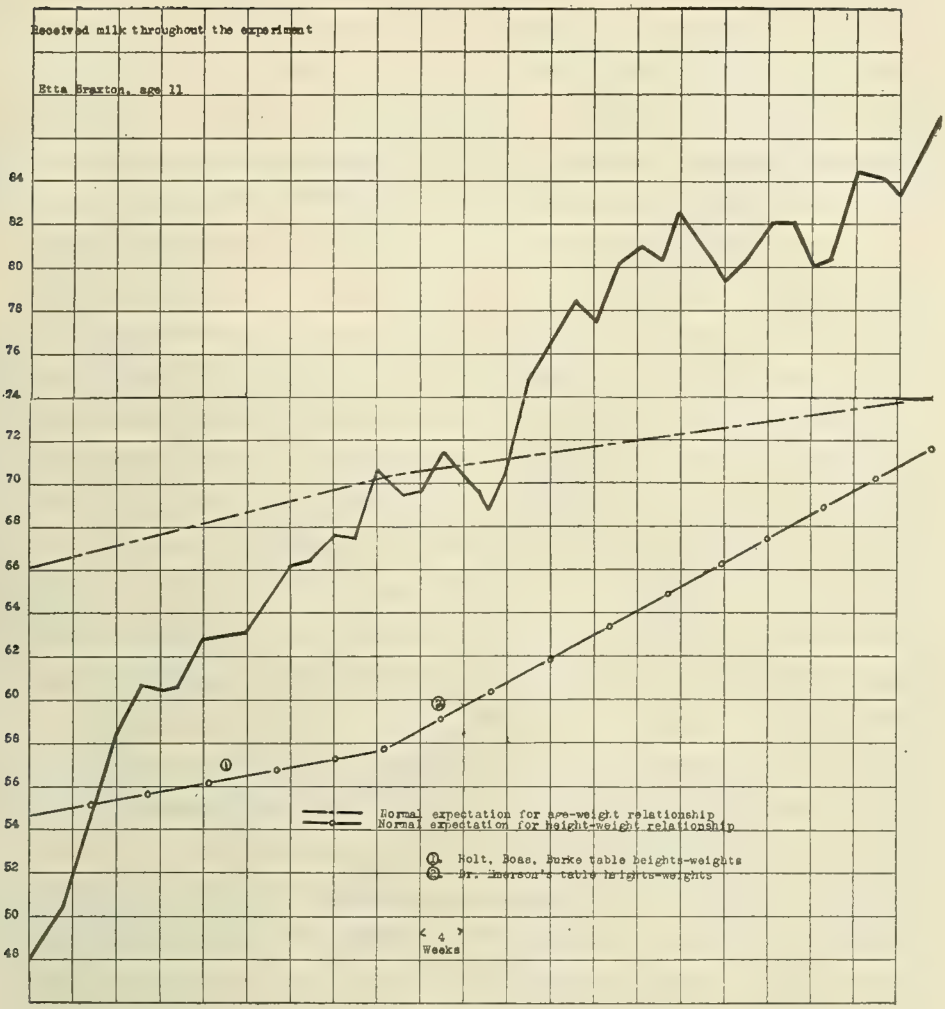


a.

b.

FIG. 4.—*a–b.* Original milk group.—Received milk throughout experiment and gained remarkably. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve.

Original milk group—Continued.



c.

FIG. 4.—*c.* Original milk group.—Received milk throughout experiment and gained remarkably. Upper broken line, normal expectation for age-weight relationship. Lower broken line, normal expectation for height-weight relationship. Solid line, growth curve.

Chairman CUMMING. I think it will probably be necessary for us, in view of the important papers which are to follow, to have the discussion at the end of the reading of the formal papers, so that the gentlemen who have prepared papers will be sure to be able to read them.

It is unnecessary for me to introduce to you Dr. L. B. Mendel, of Yale University. Professor Mendel is one of the pioneers in this work. We all know about the work of Doctor Mendel in showing the value of vitamin A. [Applause.]

MILK AS A FOOD.

Lafayette B. Mendel, Ph. D., Sc. D., Sterling professor of physiological chemistry, Yale University, New Haven, Conn.

The recognition of milk as a food of unique value for the dietary of man is not new in the literature of the science of nutrition. In the "Bridgewater Treatise on Chemistry, Meteorology, and the Function of Digestion," printed in Philadelphia in 1834, Prout stated, after pointing out that "a diet to be complete must contain more or less all of the three staminal principles," the albuminosa, saccharina, and oleosa:

> The composition of the substances, by which animals are usually nourished, favours the mixture of the primary staminal alimentary principles; since most of these substances are compounds, of at least two, of the staminal principles. Thus, most of the gramineous and herbaceous matters contain the saccharine and the glutinous principles; while every part of an animal contains at least albumen and oil. Perhaps, therefore, it is impossible to name a substance constituting the food of the more perfect animals, which is not essentially a natural compound of at least two, if not of all the three great principles of aliment. But it is in the artificial food of man that we see this great principle of mixture most strongly exemplified. He, dissatisfied with the spontaneous productions of nature, culls from every source; and by the force of his reason, or rather of his instinct, forms in every possible manner, and under every disguise, the same great alimentary compound. This after all his cooking and his art, how much soever he may be disinclined to believe it, is the sole object of his labour; and the more nearly his results approach to this object, the more nearly do they approach perfection. Even in the utmost refinements of his luxury, and in his choicest delicacies, the same great principle is attended to; and his sugar and flour, his eggs and butter, in all their various forms and combinations, are nothing more or less, than disguised imitations of the great alimentary prototype milk, as furnished to him by nature. (P. 260.)

Subsequently the foremost trend of the scientific study of milk for many years lay in the direction of compiling analyses of this product with special reference to the content of one or more of the proximate principles or foodstuffs therein. As new or improved methods of chemical examination of organic fluids were introduced, additional data were accumulated with respect to the proportions of water, proteins, sugar, inorganic salts, and particularly the fats in milk. The technical procedures gradually became standardized so as to permit the speedy execution of such analyses. At first the reports of the study of milk contained the summary of a few dozen of estimations; presently it became customary to bring these together by the hundreds, until at length the facts respecting the composition of milk appeared to lack real scientific respectability unless they were based upon literally thousands of analyses. This is characteristic of many "standardized investigations." To one who surveys the subject in retrospect it must seem strange that so much energy was expended in many laboratories upon the proximate analysis of milk when so much of far greater import remained to be discovered. Perhaps one reason for what has happened lay in the quantitative aspects of the subject. With 98 per cent or more of the constituents of milk recognized, the seemingly insignificant unidentified remainder made a lesser appeal to the investigator.

The experience of more recent years, however, has in striking ways taught the importance of "little things" in nutrition. For example, the physiological well-being of man seems to depend in certain regions in large part upon the possibility of assimilating a fraction of a milligram of iodin from time to time. Proteins and fats, carbohydrates and calories assume a minor rôle in the hygienic concern of the individual when his thyroid functions fail to proceed properly, owing to the lack of some seemingly minor essential ordinarily furnished by his food and drink. It is perhaps worthy of emphasis here that more than one fact indicating the large physiological significance of some " little thing " has been derived from the study of milk, Prout's prototype of a perfect food.

The progress of the modern science of bacteriology has directed attention to the microorganisms associated with milk and its products. At first only the baneful bacteria aroused popular interest. The menace of disease-carrying milk should never be minimized; but the fear of germs has long prevented the deserved recognition of the more beneficent part that bacteria in milk may play in nutrition. From a technical standpoint dairy bacteriology has been of great help to the milk industry. Latterly, the consumer of milk has in many instances had hopes of unusual personal benefit raised by the current propaganda regarding the use of milk products containing acidophilic microorganisms. The fashion of to-day has replaced the *Bacillus bulgaricus* by the *Bacillus acidophilus* as the presumably helpful alimentary invader. The current situation has recently been summarized by an expert for the American Medical Association as follows:

> Milk soured by acid-producing organisms which are more or less natural to ordinary commercial milk, or by certain types or species which are intentionally added with or without the association of alcohol-producing yeasts (kefir, kumyss), has been used as a food for centuries. This more or less extensive practice is due to the fact that the products were palatable to many, or rested on the assumption among the laity, as well as physicians, that they were beneficial in the correction of certain disorders of the gastro-intestinal tract. A great stimulus to the employment of fermented milks was given by the theories of Metchnikoff regarding intestinal putrefaction. These theories were in part that if the products of so-called " intestinal putrefaction," elaborated chiefly in the large intestine, were absorbed, by their action on the walls of the blood vessels they produced arteriosclerosis and premature senility. He also advanced the theory that the growth of the proteolytic bacteria which elaborated these poisons could be modified or prevented by the presence in the intestines of lactic acid-producing bacteria. For this purpose he advocated the use of *Bacillus bulgaricus.*
>
> During recent years, reports have been published from different laboratories which indicate that the growth in the intestinal canal of the normally present *Bacillus acidophilus* may be increased so as to make it the predominating organism, by the administration of lactose (sugar of milk), by milk inoculated and fermented with *Bacillus acidophilus*, or by the administration of viable cultures of *Bacillus acidophilus* in conjunction with lactose. Growing out of the claims of favorable therapeutic action which are based on more or less extensive experimental data, the use of so-called *Bacillus acidophilus* milk and other products prepared with *B. acidophilus* has become quite widespread in this country. While no one subscribes seriously to-day to the original theories of Metchnikoff, there are many who believe that the regulation of types of bacteria and of the bacterial activities in the intestine is of much importance from the health standpoint. Since *B. acidophilus* and its very close neighbor, *B. bifidus*, are very common and as a rule the predominating types in the intestines of breast-fed infants, and, furthermore, since extensive experiments have been made which show these organisms to be of a strictly nonputrefactive and ap-

parently harmless nature, added weight is given by many to the claims made as to actual therapeutic value.

There is evidence that the administration of sour milk is at times beneficial. This is particularly true in pediatrics, in which field fermented milks have found a wide application. Sour milk and sour milk products are used in cases of vomiting, and of acute diarrhea, as well as chronic disturbances of the gastrointestinal tract. On what the particular value of sour milks as such depends is not known at the present time. There can be no doubt that a wide clinical observation gives a basis for the opinion that, for certain types of gastric and intestinal disturbance, fermented milk accomplishes more than sweet milk with a similar fat, sugar, and protein content. No one will, of course, deny the great value of milk as a growth-producing and energy-yielding food, whether the milk is sweet or whether it is soured by any of the so-called " lactic acid bacteria."

Recent observations made at various laboratories seem to indicate that, in contrast with *B. acidophilus*, *B. bulgaricus* can not be implanted or made to proliferate in the intestine, even when administered in large numbers. Much doubt is cast, therefore, on any alleged physiologic action that this organism was claimed to have in the intestine. It is for this reason and because *B. acidophilus*, according to numerous reports, can be successfully implanted, that preference is now given by many in the use of lactic acid bacillus cultures to those prepared with *B. acidophilus*.

There is little, if indeed any, satisfactory proof that liquid cultures or aqueous suspensions of lactic acid-producing organisms are of real value as local applications to mucous membranes or in arresting putrefaction or suppuration in wounds, abscesses, and sinuses. In such conditions their use appears to be still in the experimental stage.

Sour or fermented milk may be administered in the form of buttermilk or naturally soured skim milk, the lactic acid being produced by *Streptococcus lacticus*, which occurs commonly in milk and other dairy products and grows readily at ordinary room temperature; also in the form of sour milk produced by *Bacillus bulgaricus*.

To these may be now added the so-called *Bacillus acidophilus* milk which is prepared by the inoculation of milk which has been previously sterilized or heated for about an hour, at or near boiling temperature, with a pure starter made by inoculating pressure-sterilized milk with viable *B. acidophilus* and incubating at from 35° to 37° C. for from 20 to 24 hours. On the completion of proper ripening, which should take place within from 20 to 24 hours at from 35° to 37° C., a product is obtained which is slightly sour to the taste and has a characteristic odor not very unlike ordinary pure buttermilk. There is a slight separation of whey, but on thoroughly mixing the product has a uniform creamy consistency. Acidophilus milk is produced in various laboratories and dairies, though in many instances with partial success only. It may be made from fresh skim milk, whole milk, or from skim milk to which varying amounts of cream have been added. In all milk-culture work, mass inoculation with the use of a sterile pipette is necessary. The preparation of uniform pure acidophilus milk requires adequate facilities, the aid of a trained technician, and close adherence to instructions.

At least four distinct proteins have already been separated from the milk of certain species and demonstrated by biological tests to be individual substances. Among them casein and lactalbumin have long been recognized by physiological chemists. Inasmuch as proteins are at present differentiated and evaluated from a nutritive standpoint on the basis of their comparative amino acid make-up, a recent compilation made for me by Dr. H. B. Vickery of the best determinations at present available may be of interest here. The data regarding several other proteins are presented for comparison with casein and lactalbumin.

	Casein.	Lact-albumin.	Gelatin.	Gliadin.	Zein.	Edestin.
Glycocoll	0.45	0.37	25.5	0.00	0.00	3.80
Alanine	1.85	2.41	8.7	2.00	9.79	3.60
Valine	7.93	3.30	0.0	3.34	1.88	6.20
Leucine	9.7	14.03	7.1	6.62	19.55	14.50
Proline	7.63	3.76	9.5	13.22	9.04	4.10
Oxyproline	0.23	(?)	14.1	(?)	(?)	(?)
Phenylalamine	3.88	1.25	1.4	2.35	6.55	3.09
Glutaminic acid	21.77	12.89	5.8	43.66	26.17	18.74
Oxyglutaminic acid	10.5	10.00	0.0	2.4	(?)	(?)
Aspartic acid	4.1	9.30	3.5	0.58	1.71	4.50
Serine	0.5	1.76	0.4	0.13	1.02	0.33
Tyrosine	4.5	1.95	0.01	1.61	3.55	2.13
Cystine	(?)	1.73	(?)	0.45	(?)	1.00
Histidine	2.5	2.61	0.9	1.49	0.82	2.19
Arginine	3.81	3.47	8.2	2.91	1.55	14.17
Lysine	7.62	9.87	5.9	0.63	0.00	1.65
Tryptophane	1.5	2.4	0.00	1.0	0.00	1.5
Ammonia	1.61	1.31	0.4	5.22	3.64	2.28
Total	90.17	83.41	91.31	87.61	85.27	83.78

Broadly speaking, these milk proteins are of good nutrient quality. They can supply all, or at any rate very nearly all, of the amino acid factors requisite for nutrition. The biological signficance of the different proportions of the individual proteins in the milk of various species remains a much discussed but little understood problem. The preponderance of casein in cow's milk and of the other proteins in human milk, for example, has long furnished a topic for scientific speculation. Lately attention has been directed to the possible importance of colostrum and its unusual complement of protein constituents. According to the studies of Theobald Smith and his coworkers, colostrum is the chief agent in transferring known antibodies to the newborn calf, and seems to have the important function of protecting the newborn animal of this species against invasion of harmful microorganisms into the intestinal tract during the first few days of life. No such signficance has been demonstrated for colostrum in relation to the human infant.

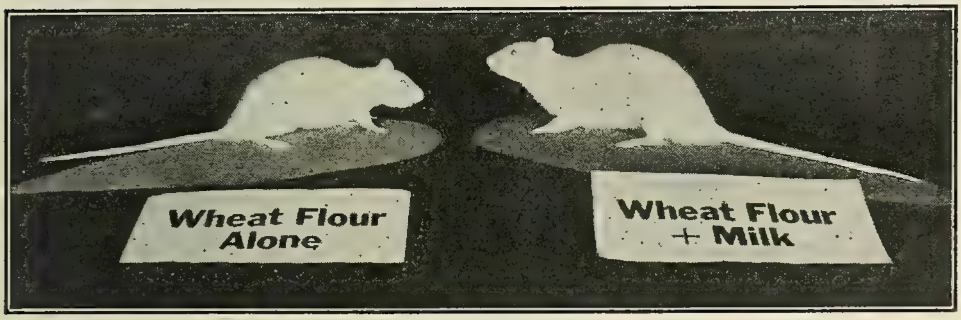


FIG. 1.—Showing the effect of the addition of milk to a cereal food.

Feeding experiments conducted in recent years have shown the value of the milk proteins in supplementing some of the albuminous substances which enter the dietary from other sources, notably the cereal grains that play so large a part in the food of man. From a protein standpoint the addition of milk to cereals as is so commonly done in the present day regimen represents an advantageous improvement in the quality of the grain products. An illustration of what this may mean is shown in Figure 1.

With respect to the milk fats per se there is little new to be said. Owing to their somewhat peculiar composition, represented by a relatively large component of glycerides of the volatile fatty acids, they doubtless have certain culinary advantages which have long been recognized. The peculiar rôle of milk sugar in the alimentary tract has already been referred to in reference to lactic acid milks. It is perhaps a signficant fact that milk sugar has been an abundant constituent of experimental diets recently devised with success to prevent intestinal toxemia and consequent tetany in animals deprived of their parathyroid glands. Under such feeding there is a practically complete suppression of bacterial proteolysis in the bowels, the feces become odorless and acid, and the intestinal flora is changed in a striking way.

It is an interesting fact that some of the earliest fundamental observations which led to the appreciation of those essential dietary factors now designated as vitamins were made in relation to milk and its derivatives. Hopkins, in England, had observed that certain animals failed to thrive on mixtures made up of an abundance of protein, fat, carbohydrate and inorganic salts, in the customary proportions of a so-called balanced ration, whereas they promptly improved in nutritive condition, and the young began to grow, when small additions of milk were made to the dietary described. It soon became evident that the successes were not due to calories or the then familiar nutrients.

Similarly the earlier attempts of Osborne and myself to feed mixtures of more or less purified proteins, fats, carbohydrates and inorganic salts ended, like the trials of other investigators, in failure. Sooner or later the animals refused to eat the food mixtures in sufficient amounts and declined in nutritive condition. They could usually be restored by a supply of " natural " foods. We were emboldened, however, to repeat the attempts again and again, because other animals throve on a food as simple as milk seemingly is.

Accordingly we determined presently to supply the mineral ingredients of our artificial diets in the form of what we termed " protein-free milk "—that is, the dried residue of milk after separation of its fats and proteins. Aside from traces of unremoved albuminous ingredients, it contains the milk sugar and inorganic elements along with small amounts of unidentified components.

The protein-free milk, which we first prepared in 1911, proved to hold a secret to success in our experimentation. On mixtures of such protein-free milk, sugar, starch, and purified fats, along with selected isolated proteins, young white rats have grown to maturity and have in turn produced young even in the third generation. Evidently the protein-free milk contained something present in small amounts not represented by the familiar salts and organic nutrients yet essential to adequate nutrition. At first we were inclined to ascribe the good results to a more favorable supply of salts in the protein-free milk component of the mixture of isolated food substances. Presently, however, we were led, in common with other investigators working in different ways, to appreciate that we were dealing with unique factors requisite for physiological well-being.

After attaining some success in preparing mixtures of isolated food substances (including protein-free milk with its unrecognized essential factors), so that animals could be nourished more satisfactorily, it was observed by us that growth invariably ceased after a time, and nutritive disaster ultimately ensued unless certain changes were made in the diet. Osborne and I had kept rats through two generations on a diet consisting of whole milk powder, lard, and starch. When we attempted to grow young animals on a comparable diet of isolated protein, protein-free milk, carbohydrate, and lard, there was a suspension of growth, sometimes quite sudden and usually more gradual, before adult size was reached. The essential difference between the adequate and the inadequate ration just described lies in the absence of the milk fat or cream element of the latter. We found that addition of unsalted butter or of butterfat to the inadequate diets in which lard formed the fat component prevented the suspension of growth in ungrown rats and promptly restored growth when it had failed. Milk fat, which includes all the milk constitutents soluble in the fats proper, therefore contains something essential for the nutrition of growth. Similar observations of the existence of such an unidentified "essential" had been made by McCollum and his collaborators. Since these experiences, published in 1913, comparable "potencies" have been discovered in a number of animal fats, notably the tissue fats, among which liver oils are striking illustrations, whereas they are missing in most other edible fats, particularly those of plant origin.

The effects of the lack of these two dietary essentials discovered in milk is shown in young experimental animals by a retardation of growth and nutritive decline, whereas there is improvement of nutrition when the missing factor is added to an otherwise adequate diet.

Whether and to what extent milk may furnish some additional specific factor requisite for the proper development of the generative organs and the satisfactory fulfillment of their natural functions is being investigated in several laboratories in this country at the present time. The antiscorbutic property of raw milk (now frequently referred to as its content of vitamin C) has long been recognized. This potency can be destroyed by heat, particularly in the presence of air; and this fact has furnished the occasion for considerable familiar controversy, often of an unnecessarily acrimonious character. It apparently has also furnished the basis for many more or less incorrect or illogical statements implying that all vitamins are readily destroyed by heat even under customary conditions of culinary procedure or commercial practice. It is high time that some of these unwarranted generalizations should be corrected, for it is a fact that milk is now being dried by more than one process without serious loss of any of the three familiar vitamin potencies referred to.

In this connection it may be worth while to direct attention to two features respecting the known vitamins in milk that seem not always to be adequately appreciated. In comparison with some other products milk is not extremely "rich" in vitamin A, B, or C. Gram for gram it may be surpassed in this respect by various edible products, few of which, however, show an equally liberal content of all the potencies found in milk. To place dependence on milk alone for the requisite supply of vitamins may mean the ingestion of large quantities. Man's requirements are far from being established on a quantitative basis to-day. In so far as current experimental evidence goes, it gives no warrant for the assumption of magical vitamin potencies in a spoonful or two of milk. Furthermore, inasmuch as the vitamins are apparently not manufactured anew in the organism but are derived by animals from their feed, it is easily understood why there may be differences between summer and winter milk in some sections. Failure to recognize this doubtless accounts for some of the contradictory reports, particularly with regard to vitamins A and C. The problems of dairy feeding thus have come to have a direct relation to the nutritive quality of milk with respect to its vitamins.

The current enthusiasm for the vitamin hypothesis, and the demonstrations that have supported it, have perhaps been allowed to overshadow a feature of the composition of milk that deserves to be more widely heralded, namely, the inorganic elements therein. Milk remains to-day as the most available source of calcium, an element present to the extent of several pounds in the adult human body. The typical American dietary with a large abundance of cereal grains of various sorts, of meats and potatoes, of sugar and fats, with a sparse inclusion of green vegetables and fruits, deals with products for the most part notably poor in calcium. In harmony with what one might thus expect, Professor Sherman's fundamental studies indicate that a deficit in calcium is perhaps the most probable immediate error in the eating habits of the present day. From this standpoint alone the more liberal use of milk in one form or another must make an appeal to those interested in the promotion of national health. The bodily store of calcium is large and is drawn upon with apparent physiological ease; but this should not lead us to overlook or underestimate the fact that a prolonged negative balance may mean real harm for the organism.

Milk is not a cure-all. There are a few persons who have an undeniable idiosyncrasy, usually some anaphylactic manifestation, which may preclude the use of this food in their diet; other persons have a fancied dietary grievance against milk. They are not the mass of our population. Nevertheless, these are days of extreme propaganda with the admonition to eat more of this or that. Milk doubtless is vital to national health, but the wholesale advice to "drink more milk" meets with real or fancied limitations in some persons. It is, however, often agreeable or advantageous to increase the intake of certain ingredients of milk by the use of products other than fluid milk. Herein lies the pressing opportunity for the intelligent introduction of some of the increasing varieties of milk-made foods.

Chairman Cumming. Doctor Blackham, who was to have presented a paper, "Milk in the Tropics," is not here. We will, therefore, proceed with the paper following, which is to be presented by Dr. H. C. Sherman, professor of food chemistry, Columbia University. [Applause.]

THE OPTIMUM AMOUNT OF MILK FOR CHILDREN.

HENRY CLAPP SHERMAN, Ph. D., professor of food chemistry, Columbia University, New York City.

In view of the fact that most physicians and dietitians advocate a quart of milk per day for every child, while some believe that a smaller amount may do as well, the New York Association for Improving the Condition of the Poor, with the cooperation of the department of chemistry of Columbia University, undertook a somewhat extended series of experiments upon children from 3 years to over 13 years of age, to determine what quantity of milk per day, taken as part of a normal diet, would induce the best storage of calcium and phosphorus in the body of the growing child and hence, presumably, the best development of bones and teeth.

The investigation was made possible by a grant from the research fund established by Mrs. Elizabeth Milbank Anderson.

Groups of average children who had volunteered for the experiment were taken as visitors to the suburban house maintained by the association, where they lived normally for periods of from 10 to 50 days under the constant personal observation of my colleague in the research, Miss Edith Hawley. The research worker maintained constant supervision and control of the children, sleeping in the same room with them, preparing and serving their food, eating with them, and recording and analyzing the complete food intake and excretory output of each child separately throughout the entire time that each was under investigation. In this way the balance of intake and output was determined with the highest possible accuracy while at the same time all the children led perfectly normal lives.

The investigation as a whole consisted of four progressive series of experiments, including in all 21 children ranging in age from about 3 to about 14 years, and covering a total of 417 experimental days.

In the first series of experiments the children received ordinary mixed diet, including 750 grams (about three-fourths of a quart) of milk for each child daily, this being the approximate amount to which they were supposed to be accustomed in their home dietaries. This diet resulted in their storing calcium in quantities approximately proportional to their body weights. In the second series, when the amount of milk was increased to 1,000 grams (1 quart) per child per day, the rate at which the children stored calcium was materially improved. Very careful studies with systematic increases and decreases in the daily allowance of milk led to the conclusion that, whether at 3 or at 13 years of age, the child must be fed a quart of milk per day to insure the optimum storage of calcium and phosphorus and the best development of bones and teeth.

The third and fourth series of experiments were planned to ascertain whether children utilize the calcium of vegetables as well as that of milk, and whether, with a larger use of vegetables, the consumption of milk could be reduced without detriment. This was found not to be the case. While liberal use of vegetables in the dietaries of children is doubtless good dietetics, the vegetables should be used along with the full allowance of a quart of milk per day.

All of our many experiments in which about one-half of the milk of the diet was replaced by vegetables of equal calcium content showed plainly the superiority of the milk over the vegetables as a source of calcium for growing children, and that even when vegetables are freely used the child should still have the full quart of milk per day if optimum results are to be insured.

The full scientific account of the experiments has been published in the Journal of Biological Chemistry for August, 1922, and a shorter and less technical account has been given in the Journal of Home Economics for September, 1922. The results as a whole emphasize strongly and in most convincing fashion the importance of the quantity of milk consumed. In view of these results and of our present knowledge of the practical equivalence of raw, Pasteurized, condensed, and dried milks from the nutritional standpoint, it would appear that the form in which milk is used may be largely left to the choice of the consumer and the nature of the available supply, and that we may well devote ourselves more especially to the effort of insuring the consumption by every growing child of the equivalent in some form of a quart of whole milk per day. It should also be emphasized that these experiments show the importance of continuing the consumption of a quart of milk per day up to at least the age of 13 to 14 years.

As pointed out editorially in the Journal of the American Medical Association in the discussion of the experiments above described: "The dietary rule of a quart of milk each day for every child is much more than a precept based on individual opinions or drawn by analogy from the results of feeding experiments with lower animals; it now rests on scientific evidence obtained by extensive and intensive experiments directly upon the children themselves."

The method of investigation used in the experiments above described, depending as it does upon the measurement of the storage of calcium and phosphorus in the growing body, is applicable only to children of ages at which active growth is to be expected. To study the effect of different levels of milk consumption upon the later development and health of human beings would involve so many and such long experiments as to be quite impracticable. It is, however, possible to determine by means of studies with laboratory animals of rapid development, like the rat, the effect of different levels of milk consumption when all other conditions of life are maintained strictly uniform. This has been studied in the writer's laboratory through several generations of experimental animals, with results which show plainly that the more liberal allowance of milk, corresponding approximately to 1 quart of milk per day in the human dietary, greatly increases the vigor of the young adult, and confers improved health and vigor and much better success in the bearing and rearing of young throughout middle life, the same change in dietary (namely, an increased proportion of milk in a food supply already adequate according to current standards) actually postponing old age in the same individuals in which it has induced earlier maturity.

In view of such evidence it seems a mistake to limit the recommendation of a quart of milk per day to the ages from infancy to puberty. Undoubtedly it would better be extended, probably to all ages. Certainly it seems to me the boy should have his quart of milk per day until he is a man full grown, and the girl should continue to take her quart of milk per day until as a woman she has weaned her last child.

Chairman Cumming. Professor Bloch will now address us on "Blindness and other diseases in children arising in consequence of deficient nutrition." Professor Bloch, of Denmark, years ago discovered an eye disease which occurred in children and which later was recognized by Doctor Mendel as being due to a deficiency in vitamins. [Applause.]

BLINDNESS AND OTHER DISEASES IN CHILDREN ARISING IN CONSEQUENCE OF DEFICIENT NUTRITION (LACK OF FAT-SOLUBLE A FACTOR).

C. E. Bloch, M. D., professor of medicine, University of Copenhagen, Denmark.

While blindness in children has been on the decrease in the greater part of the civilized world, the opposite has taken place in Denmark. Blindness in children has increased not only absolutely, but also relatively to the population. Many causes have contributed to the diminution of blindness in other countries, but the chief one undoubtedly is that gonorrheal ophthalmo-blennorrhea in the newborn has become a rare disease as a result of the special measures which have been adopted against it everywhere. That gonorrheal ophthalmia has become a rarity also applies to Denmark, but in spite of this the percentage of blindness in children is increasing.

There is, however, another disease of the eye peculiar to childhood which leads to blindness. This is xerophthalmia. It was first described in the middle of the last century by German ophthalmologists. According to all previous reports xerophthalmia had a very serious prognosis, as it occurred particularly in the final stage of a cachectic condition due to a protracted wasting disease, such as tuberculosis, syphilis, typhoid fever, acute or chronic digestive diseases, etc., and especially in badly nourished and debilitated children.

In the middle and close of the last century and in the beginning of this, "epidemics" of an eye disease were described which were undoubtedly identical with xerophthalmia. These epidemics occurred among negro children in Brazil, during periods of fasting in Russia, when famine and summer diarrhea accompanied one another in Japan, and it was always the badly nourished and diseased children of the poorer classes who were attacked. The majority of the authors who have described these epidemics, therefore, associate xerophthalmia in children with a bad and deficient diet. Primitive medicine in Japan, Russia, and other countries has from ancient times treated this eye disease with fat substances, especially cod-liver oil and liver, and Mori has declared that the disease is due to lack of fat in the diet.

In Europe xerophthalmia is considered to be extremely rare. A few cases have previously been recorded in badly nourished children in England and Denmark, while in Germany Czerny and Keller and, according to them, several others have now and again observed xerophthalmia in the final stage of the nutritional disease they call "Mehlnährschaden."

The children's department of the Danish State Hospital was opened in 1911. Even by the next spring a number of children were admitted with a curious eye disease which proved to be xerophthalmia, and in the following year the number increased to an alarming extent. I thus had the opportunity of studying this disease in its different forms and stages, about which I published communications, some long and others short, in 1914, 1916, 1917, 1918, and 1922.

My investigations indicated that the disease was due to a lack of a particular substance. This substance was present in fresh milk, but not in separated milk or buttermilk. It was therefore united with the butterfat, and it was also found in abundant quantities in cod-liver oil. My investigations further showed that the disease could not be attributed to the absence of fat as such, because even though the children had received margarin or pork fat, they could easily get xerophthalmia.

In England and the United States a large number of experimental investigations into nutrition were carried out partly before and partly at the same time as my work. From these inquiries we became further acquainted with the cause of xerophthalmia and the disease associated with it. It was from the animal experiments of Osborne and Mendel, and especially of McCollum and his collaborators, that we now know that the cause of xerophthalmia is the lack of the fat-soluble A factor. This body, which is united with certain fat substances and is notably found in large quantities in butter and cod-liver oil, must be constantly supplied to the organism, particularly the growing organism, in order that growth shall take place; deprivation for a long period leads to xerophthalmia and death.

When a child, particularly one in the first few years of life, is deprived of its mother's milk or fresh milk, as well as cream and butter, and is kept for a long time on a diet consisting of puddings made with separated milk or buttermilk, bread and other farinaceous foods, potato mash, a little pork and other meat, margarin and pork fat, it will become ill as a result of the absence of the fat-soluble A factor. Even if the child eats a little vegetable, fruit, and green stuff now and again it will not help much, for a small child can digest only trifling amounts of green stuff.

A deficiency of the fat-soluble A factor may also occur in children who have received a quantity of pure milk, but in such cases the milk must have been stale and modified adversely, the fat-soluble A factor being destroyed by oxidation and repeated heating.

The disease is ushered in by the child's ceasing to gain weight. Later on there is a loss of weight and the child remains motionless and apathetic. In other words, there is inhibition of growth and depressed psychic and bodily vitality. These children are liable to be attacked by some infectious disease which usually takes the form of a simple catarrhal infection of the mucous membranes, particularly of the respiratory organs and middle ear. *B. coli* infections of the urinary tract and infectious dermatitis are also frequently observed. These infections are extraordinarily persistent and often have a fatal issue. An increased susceptibility and a diminished power of resistance against infections are therefore present.

The eye lesion does not appear, as a rule, until late in the disease. It first occurs in the form of night blindness (hemeralopia) and dryness of the ocular conjunctiva (xerosis). The dryness later extends over the cornea, which becomes hazy, shrivels up, and shortly after pieces of it become necrosed (keratomalacia). In most cases the ocular conjunctiva is infected; the child then has photophobia, the conjunctiva is red and swollen, and the eye begins to water. When the cornea necroses the inflammation spreads to the interior of the eye. The inflammation may be so intense and widespread in many cases that it almost obscures the original xerosis. The eye lesion can be distinguished only with difficulty from the destructive inflammation in such cases. If the disease is not recognized in time the

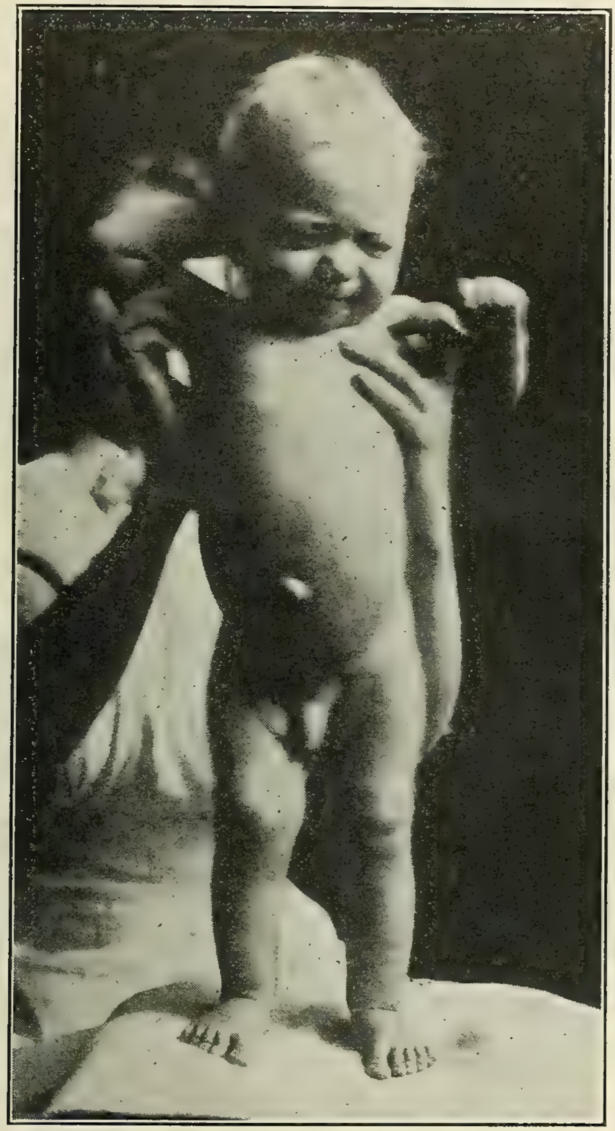


FIG. 1.—Diseased condition of the eye resulting from a deficiency of fat-soluble A.

child becomes blind. If the child does not then die of a secondary infection first, the most frequent cause of death is broncho-pneumonia.

In Figure 1 such a patient is seen, a boy of about 2 years. He appears to be a healthy child, the eyes only being swollen and kept tightly closed. He is, however, of small size and weighs less than normal. He also has a catarrhal infection.

In Figure 2 his eyes are seen to be completely destroyed. The conjunctiva is swollen and red, both corneæ are necrotic and there is pus in the anterior chamber. The child was cured but became totally blind, as the cornea never heals with clear transparent tissues. The scars are always hazy and opaque, as will be observed from the succeeding pictures of children who were cured. (Figs. 3 and 4.) In cases where the cornea is only partly damaged the child, however, may usually be saved from complete blindness.

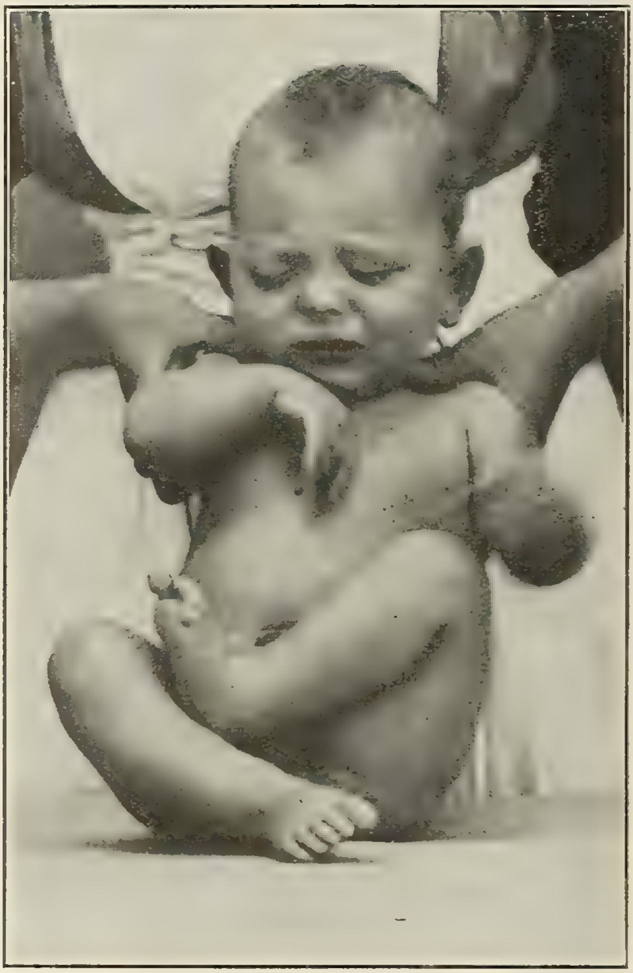


FIG. 2.—Advanced stage of disease. The eyes are completely destroyed.

If a small child receives no milk whatever, not even separated milk or buttermilk, but is given only water, tea, gruel, and the like for a prolonged period on account of diarrhea or other malady, the child will diminish in size and become atrophic, with dry, wrinkled skin, but otherwise it will resemble the first type, as will be seen from Figure 5. In this case, in addition to the absence of the fat-soluble A factor, several others are missing, but it is essentially the primary wasting disease—in this instance the intestinal trouble—which dominates the entire clinical picture. Such a case answers most nearly to the xerophthalmia described by the older authors. When the child is a little older and stronger, and not ill, it can apparently thrive for a long time on an essentially carbohydrate diet, but sooner or later the tissues become edematous, and if the child has received no fresh milk, xerophthalmia and bronchopneumonia, etc., may supervene just as in the first type.

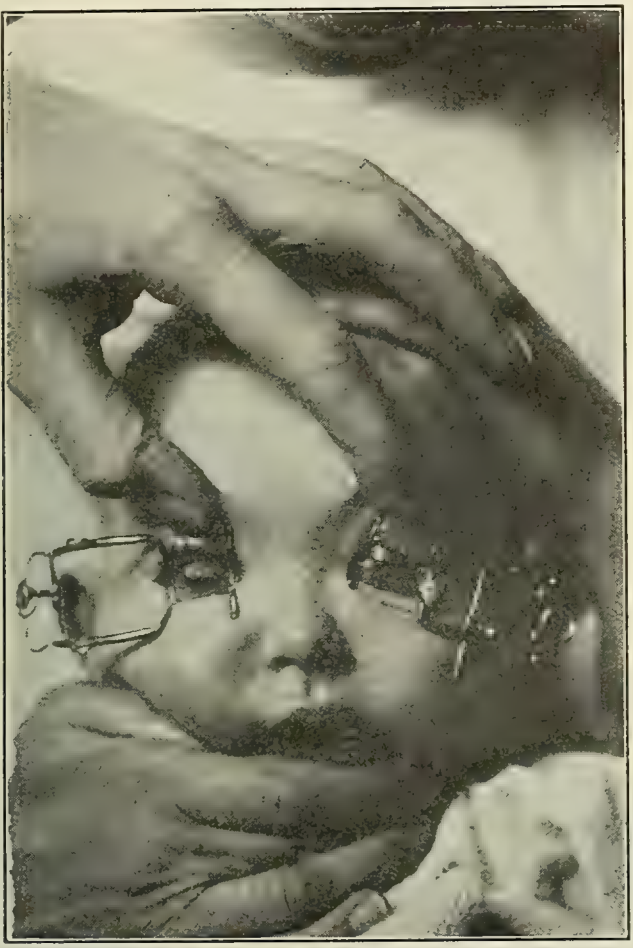


FIG. 3.—The patient has been cured but is totally blind, as the cornea never heals with clear transparent tissues

If the child has had only a little butter in addition to the carbohydrate diet, edema, like that in Bright's disease, can certainly occur, but neither xerophthalmia nor marked changes in resisting power are observed, and the child is easily restored to health when it receives milk. Figure 6 shows such a case with an enormous amount of edema, but with no eye lesion.

Besides the xerophthalmia, the characteristic symptoms in this disease, which arises in consequence of the absence of the fat-soluble

A factor, are therefore inhibition of growth and diminished immunity and vitality. In bigger children and adults, who hardly utilize so much fat-soluble A factor as the small child, the disease may be merely represented by the latter symptoms. It is only when the lack of the fat-soluble A factor in the food has been almost absolute for a long time, or when the consumption of it has been very great, e. g., in chronic infectious diseases, that the bigger chil-

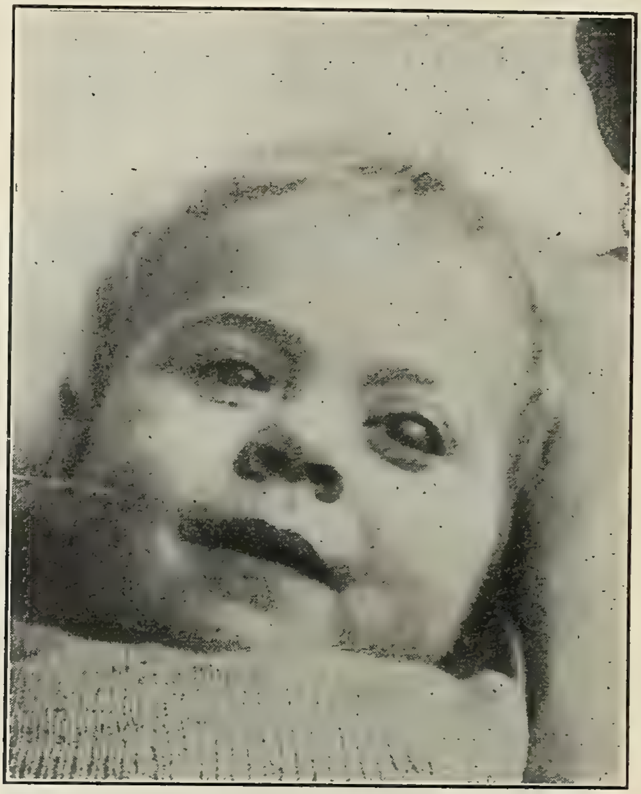


Fig. 4.—Showing same condition as Fig. 3. The scars are hazy and opaque.

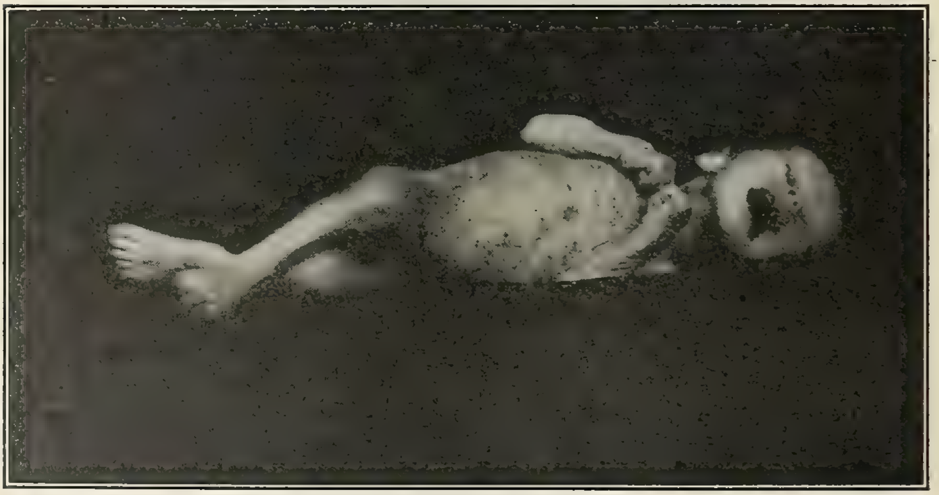


Fig. 5.—Showing a primary wasting disease due to entire lack of milk in the diet.

dren get xerophthalmia also. It is chiefly the small children—that is to say, those under 2 to 3 years of age—who get xerophthalmia, and this may happen even though there has been some fat-soluble A factor in their food.

During the war there was much sickness among the bigger children in central Europe, which took the form especially of inhibition of growth and a large number of infectious diseases running a grave course. Thus many children were attacked by tuberculosis. The smaller children, on the other hand, were remarkably little affected and xerophthalmia was hardly seen at all in them. This state of affairs was due to the fact that during the war all the milk and milk products in Germany were rationed so that every little child obtained a certain amount daily. If the child was being suckled by the mother, she got the milk, and xerophthalmia was never observed in children suckled by a mother capable of yielding sufficient milk.

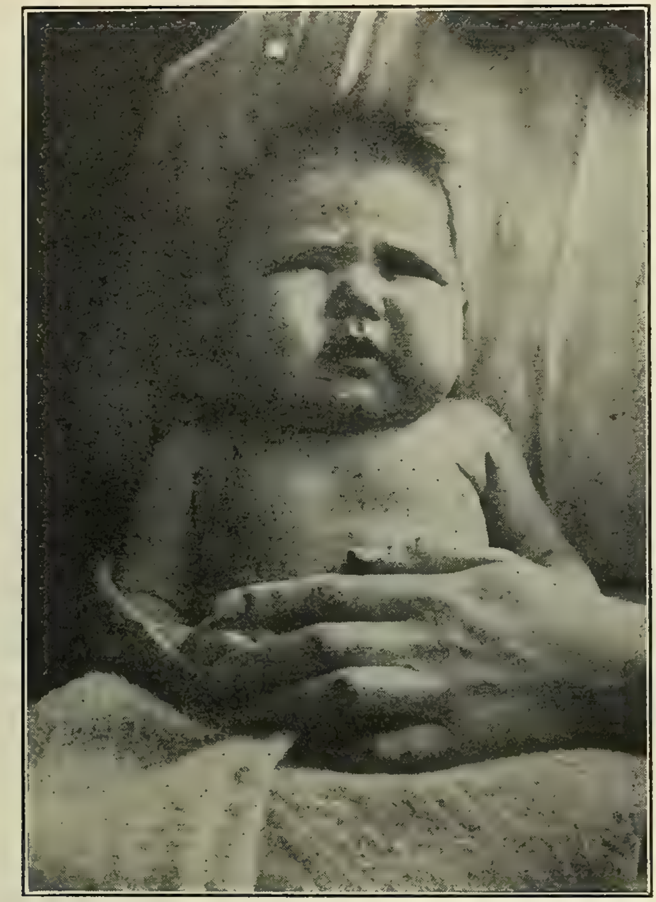


Fig. 6.—Edema without eye lesions due to a deficiency of butterfat.

In Denmark the conditions, as mentioned, were different; before, and especially during the war, there were many cases of xerophthalmia. In a recent investigation undertaken for the Danish Ophthalmological Society by Olaf Blegvad, from 600 to 700 cases of xerophthalmia were found to have occurred between the years 1909 and

1920 in children in a population of less than 3,000,000, and in addition to these there were probably others.

The reason xerophthalmia was so widespread, despite the fact that Denmark did not take part in the war, is that this country is a dairy farming one which manufactures and exports butter. During the war butter, and consequently fresh milk, became so dear that the poor could scarcely procure any of it, and they were able to obtain only separated milk and buttermilk, which could always be had at a very low price. The number of cases of xerophthalmia increased, therefore, until 1918. In that year the disease was suddenly checked, as will be seen from the curve. (Fig. 7.)

The reasons were several, but the principal cause was undoubtedly that in 1918, on account of the German blockade, butter was rationed in Denmark, so that every individual, including small children, was entitled to one-fourth kilogram of butter a week, and as there was practically no pork fat or margarin in the country everybody had to eat butter. Xerophthalmia ceased simultaneously. These facts show as clearly as an experiment that the absence of the fat-soluble A factor is the cause of xerophthalmia.

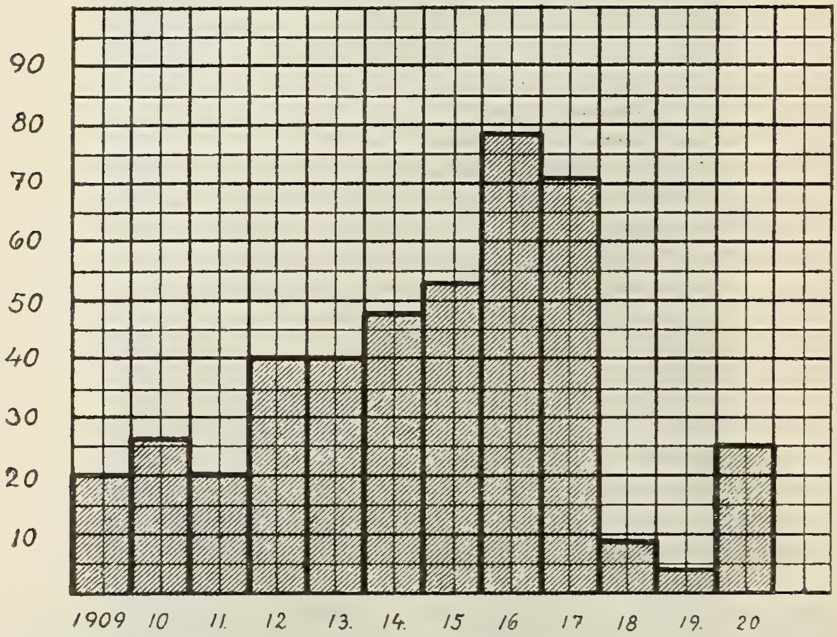


Fig. 7.—Occurrence of xerophthalmia (keratomalacia) among Danish children, from 1909 to 1920, by years (434 cases). Reported by Dr. Olaf Blegvad.

After the termination of the war the rationing of butter came to an end and xerophthalmia returned, but it was rare compared with its former incidence. It was particularly noticeable that the severe cases no longer occurred. The people and the Danish doctors had got to know the disease and had learned how to avoid and treat it.

The disease caused by lack of fat-soluble A factor is cured by supplying the latter to the afflicted organism, best in the form of fresh milk, cream, butter, or cod-liver oil. The xerophthalmia is the first to disappear, then the child begins to thrive and gradually throws off the infections. The latter are therefore cured by the administration of the fat-soluble A factor. This is in harmony with the old clinical experience that chronic infectious diseases, particularly tuberculosis, are improved by a diet rich in fresh milk, butter, and cod-liver oil.

The fat-soluble A factor is thus particularly important not only for the eye lesion but also for establishing immunity, and it is clear that a great deal of it is used up in infectious diseases. Large quantities must also be consumed during growth. This is most clearly evident from McCollum's animal experiments, but the study of xerophthalmia points in the same direction, as it occurs practically only in children; that is to say, in growing individuals. Moreover, the disease appears especially in the spring months, at which season the most marked growth of the child takes place. The cases not occurring in this annual period of growth have always been complicated by serious infections or chronic diarrhea. This distribution of the cases is shown by the curve. (Fig. 8.)

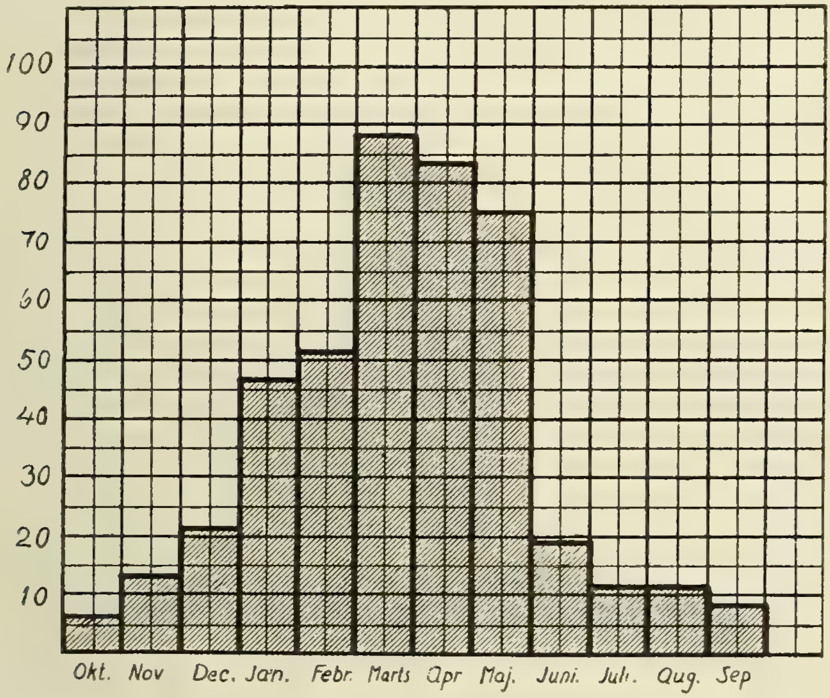


FIG. 8.—Distribution of 434 cases of xerophthalmia (keratomalacia) by months. Reported by Dr. Olaf Blegvad.

It has been thought that the accumulation of cases in the spring was due to a different content of fat-soluble A factor in the winter milk (stall feeding) and the summer milk (grass feeding). It is possible that there is more fat-soluble A factor in the first grass milk, and that this has something to do with the disappearance of the disease in the summer, but a decreased fat-soluble A content in the milk can not be the cause of the many cases arising in the growth period of the spring, because precisely the same distribution is found of cases that have received no milk or milk products at all for a long while. It is also difficult to believe that milk from healthy cows could be deficient in the fat-soluble A factor. At any rate, it has not been proved, and the experience with xerophthalmia in Denmark is against the supposition.

What I have said here and proved to you testifies to the enormous importance of milk as a food for the child. No other article can replace milk. Absence of milk from the diet or the inclusion of unfavorably modified milk is the origin of most serious diseases.

By ordering milk, and especially cream and butter, this terrible eye disease is cured—which I believe will be discovered in every country when it is looked for—and these dairy products are of the greatest importance for growth and development and for the cure of our greatest infectious diseases.

Chairman Cummings. Doctor Hamill has been good enough to consent to read a very short but excellent paper prepared by Doctor Blackham, who has had 28 years' experience in handling the milk problem in the Tropics.

(Doctor Hamill read Doctor Blackham's paper, "Milk in the Tropics.")

MILK IN THE TROPICS.

Col. Robert James Blackham, M. D., London; late honorary surgeon to the Viceroy of India.

In warm climates milk decomposes more rapidly than any other article of diet, and as every sample of it may become dangerous to health, its quality, supply, storage, and distribution are amongst the most important problems which face the statesman, the physician, the dairyman, the Government official, and the merchant whose lot may be cast for a longer or shorter period, either in one of our eastern dependencies or in the portion of this great country which borders on the tropical zone.

In some hot countries milk holds a high place in the dietary of the people, and in India, for example, it is ubiquitously used in some form or other by all classes of the community.

The word "milk" in Europe and America means cow's milk, but in the Tropics, or subtropical countries, it may mean cow's milk, buffalo's milk, goat's milk, or even sheep's milk.

The main source of supply in India is the buffalo, and in India and China practically all milk consists of a mixture of cow's and buffalo's milk.

No systematic breeding of cattle by the private owner exists, but notwithstanding a considerable number of pure breeds of cattle are found in the East. This is a somewhat surprising fact, and, further, it is not generally realized that India has several fine varieties, and exports milk cattle to all parts of the tropical and subtropical world, and that this export trade is a severe drain on her own national milk supply.

The "dairy" in a typical tropical town such as Bombay or Calcutta is often not a dairy at all in the western sense of the word. The dairymen are merely importers of milk, most of which comes in from the suburbs in open vessels, carried underneath the seats of ordinary third-class carriages, as there are neither milk cans nor milk trains.

The filthy condition of these third-class carriages in the Tropics, the clouds of dust flying directly into the open vessels, and the disgusting habits of the passengers beggar description. The milk has already been drawn under most primitive conditions, and after a slow journey of three or four hours at a temperature in the neighborhood of 90° F., often much more, very seldom less, its bacterial content when it reaches the consumer more than rivals that of ordinary sewage. The position of the milk problem in India is succinctly stated in the following resolution of the Government which declares that—

> The adulteration of milk is almost universal in Indian bazaars, and a large amount of the milk consumed is contaminated. In most cities the milk supply is in the hands of men ignorant of the elements of sanitation and addicted to uncleanly practices. Moreover, the milk when stored and in transit to market is liable to contamination in several ways. On the other hand, the price of milk is already high, and the problem of improving the purity of the supply without increasing the price to such an extent as to cause hardships to the poorer classes is a difficult one.

The last paragraph of this Government resolution is an important one, as it is not generally realized either in Europe or America that milk is not only dear but very scarce in many parts of the Tropics.

During my residence in India I had charge of Government laboratories and was struck by the fact that the sanitarian and analyst practicing in the Tropics are confronted with difficulties unknown to their colleagues in temperate climates, not the least of these being the absence of reliable milk standards with which to compare their results.

I have found that the chemical composition of cow's milk in the Tropics may be summarized as follows:

1. Specific gravity		1.027–1.032
2. Total solids	per cent	13.10–17.22
3. Fat	do	3.4–7.71
4. Solids not fat	do	9.7–9.51
5. Lactose	do	4.03–4.00
6. Ash	do	.69–.75
7. Water	do	86.90–82.78

The composition of buffalo's milk was as follows:

1. Specific gravity		1.027–1.035
2. Total solids	per cent	13.82–22.90
3. Fat	do	5.00–11.6
4. Solids not fat	do	8.82–11.30
5. Lactose	do	4.03–5.25
6. Ash	do	0.76–0.8
7. Water	do	77.10–86.18

It will be seen that both cow's milk and buffalo's milk are extremely variable products in the Tropics, and that the results, generally speaking, with regard to cow's milk do not compare favorably with European analyses. The butterfat, especially in buffalo's milk, was found to be most in warm, moist climates such as Bengal, and least in comparatively cool and dry climates such as the Punjab.

Chemical analyses of milk are useful as they enable us to say if a sample of milk is genuine or otherwise, but they do not reveal anything as to its contamination with dirt or microbes. A milk may pass all chemical tests and still be not only dirty but actually infected with pathogenic organisms.

I have endeavored to establish bacteriological standards for milk in the Tropics, but do not propose to occupy your time with this very important aspect of milk examination. I would here emphasize the fact that no examination of milk can be regarded as complete unless its bacterial content is examined, as might be expected from what I have said above regarding the way in which many samples reach a typical India town. My experience is that much tropical milk is richer in intestinal bacteria than ordinary sewage.

The measures necessary to reform the milk supply in the Tropics fall naturally under four headings: Educational, sanitary, economic, and legislative, but a large book might be written on this aspect of the question alone, and I shall only refer briefly to the first two headings.

As Rosenau says "education is one of the chief spokes in the milk wagon." Now, the essential difference between breeding of cattle in the Tropics and temperate climates is that whereas cattle are bred for food in Europe and America, meat is little used by the natives of hot countries and, therefore, the aim of the breeder is to produce stock, of which the cows will be good milkers and the bulls efficient draft animals. In India both sexes are sacred animals, the bull, bullock, and cow are hung round with ornaments and usually well fed, according to native ideas and ideals, but the tropical peasant is ignorant of the most elementary notions of hygiene as applied to cattle breeding. He is himself as poor as a sparrow, and his home lacks the comfort and security of the sparrow's nest. It is little wonder that he houses even sacred animals under conditions which offend every sanitary principle, and his ideas of feeding and tending would horrify the western dairyman. Calves are allowed to die through sheer neglect, although the slaughtering of one of these animals for food might be quite sufficient to raise a religious riot.

The governments of tropical dependencies have started government dairies, but these are run for the benefit of troops and officials, and mighty little has been done to encourage scientific breeding, so that there is still vast scope for educational propaganda on the subject. The great difficulty in the way is the poverty to which I have referred; it is far more important than prejudice, which can be readily overcome, as the oriental is a very intelligent man and takes most kindly and promptly to all modern advantages of transport and communication, while he is fully alive to the value of education and a great respecter of learning. We sometimes forget that most orientals are descendants of a civilization much older than our own.

Space will only permit me to refer very sketchily to the feeding of tropical cattle and to emphasize the point so well known to all who have studied the subject that the quality of a milk must depend on the food supplied to the animal which produces it.

The native buffalo or cow is turned out to find its living on burnt and bare patches, while even cows from Europe quickly deteriorate under a diet consisting of straw and hay rapidly ripened in tropical warmth and burnt to a cinder by a tropical sun. Such "green" food lacks the sappiness so essential to milk cattle, and it is obvious that under such conditions their milk must be an entirely different product to that produced from animals fed on the luscious pasturage of Europe, some parts of America, and some of the British colonies.

The average European merchant in hot countries keeps his own cow, and one has often been consulted by an anxious mother who has been unable to understand why the milk of this home-fed animal disagreed with the children or why they were not thriving on it. She has failed to see that the mammary secretion under tropical skies must lack the essential "goodness" which we now know to be due to the presence or absence of vitamins derived from the animal's own food supply. It is only by improving the pasturage and the supply of ample green food that the milk of tropical milk cattle can be improved and made a reliable food for growing children. The difference is striking even between the milk of native and imported cattle, and I have seen a child going from bad to worse while fed on its parents' "own cow," rapidly improve when put on the milk of a recently landed Australian animal.

The average consumer of milk in the tropics is almost as careless with regard to the storage of milk in the household as the milkman is often criminally negligent in its collection and distribution. Among the well-to-do classes the care of milk is more often than not left to ignorant and dishonest servants. The first duty of the consumer is to see that a responsible member of the household personally attends to all details with regard to the transit of milk from pasture to pail and from pail to palate. All milk should be scalded at the earliest possible moment, as we now know that the nutritious qualities of milk do not materially suffer by heat, and it is a remarkable fact that the natives of India who live largely on milk never by any chance consume it raw. Having been boiled, the milk must be carefully stored, as it is useless to attempt to sterilize the milk and then permit reinfection by dust and flies.

Pure milk produced from well-fed cattle and kept clean until its consumption is the ideal to be aimed at, but in the Tropics this ideal seems unattainable at present. It is little wonder, therefore, that the physician and sanitarian have turned with relief from the white sewage nicknamed "milk" to the attractive substitutes which have been placed on the market. Condensed milk was the first of these milk modifications, and its popularity was eloquent testimony to the demand for some substitute for the local product. For tropical use the keeping qualities of condensed milk are not much superior to fresh milk, and the large proportion of cane sugar in the sweetened variety renders it undesirable as an infant's food, and most unpalatable to most adults. Some 15 years ago my attention was drawn to a form of dried milk which since that time has steadily advanced in public favor. I carried out a series of experiments and analyses on behalf of the Government of India and formed such a favorable opinion of the product that I have ever since advocated its adoption for tropical use, and am in agreement with Professor Dreyer, of Oxford University, that it may present us with the best solution of the milk problem. To quote from the professor's paper at the National Milk Conference in London last October, 1922:

> Dry milk will keep for some months; it is very easy to manipulate cleanly in the home; there is little or no wastage from souring, etc.; it does not appear to be inferior to raw milk for feeding. (Report of National Milk Congress, p. 158.)

In the discussion which followed a paper on "Dried milk as a food" which I read before the Birmingham Congress of the Royal Sanitary Institute, 1920, the speakers agreed that they had never seen a case of rickets or scurvy in a child fed on dried milk, and as these speakers were mostly medical officers of health of important towns their evidence must be regarded as conclusive.

The position of waterless milk as an infant's food in the Tropics may be summarized as follows:

All authorities are agreed that it is eminently suited for warm climates and the well-known tropical physician, Doctor Harston of Hongkong, emphasizes the advantages of dried milk over condensed milk in China.

Dried milk is superior to fresh tropical milk in nutritional value and especially adapted to supplement breast feeding.

All experience shows that dried milk is more digestible than fresh milk, and it is therefore indicated in digestive troubles. I have found it of special value in infants who have been doing badly on other milk preparations and have seen rickety children steadily improve on dried-milk diet.

Dried milk has a wide field of usefulness as a food for adults and invalids in the Tropics. The United States Department of Agriculture has in its valuable pamphlet, "The use of milk as a food," pointed out that "milk should not be regarded as a luxury but as an economical article of diet which families of moderate income may freely purchase as a means of improving the character of the diet." This should be more widely known in the Tropics, where the European resident constantly complains of the poor quality of animal foods but nevertheless drinks little or no milk.

I have found dried milk an excellent food for nursing mothers and have had considerable experience with it in sprue and chronic dysentery. I have seen this form of milk extremely well tolerated in cases where ordinary cow's milk was badly borne and while acting as consultant in tropical diseases to the Ministry of Pensions in London I have prescribed it with success to pensioners in the later stages of these diseases.

The chief reasons which have influenced me in using milk powders in cases of chronic diarrhea and dyspepsia have been: The fine flocculent clot; the fact that dried milk can be digested in strong concentration. The chief objections to ordinary milk, namely, its bulkiness and its hard curd, are thus surmounted.

During the discussion on my paper at the Royal Sanitary Institute the medical officer of health of St. Helens spoke very highly of the value of dried milk in the dietary of typhoid fever. In my own experience, dried milk solves the difficulty of presenting a milk diet in an attractive and constant form to the subject of an acute specific fever. Samples of ordinary tropical milk vary immensely in their composition, as I have shown above, whereas dried milk from a reliable firm consists of milk solids in an invariable proportion. It is thus possible to prescribe milk with approximately the same accuracy that one prescribes drugs.

In view of the defects I have pointed out in the supply of fresh milk for use in the Tropics or in places such as Malta, where cow's milk is obtainable and goat's milk dangerous, dried milk has a wide range of application, while on long voyages, on hunting or exploration trips, it presents many advantages over condensed milk. Produced and dried under the excellent conditions attained by some manufacturers from milk of cows fed on rich pasture, it contains the essential "goodness" that Sir James Cantlie and other writers have insisted on; and on the whole, from long and varied experience of its use in war and peace, I am inclined to agree with the opinion of Professor Dreyer, that waterless milk presents the only solution at present available to the manifold problems which I have indicated as associated with milk in the Tropics.

Chairman CUMMING. The papers are now open for discussion.

Capt. JOHN GOLDING (National Institute for Research in Dairying, Reading, England). I want, in the first place, to express my indebtedness to the committee of the World's Dairy Congress for the opportunity which they have given us to meet face to face so many of the pioneers in this new work on the nutritive value of milk. It gives me great pleasure, and I feel compensated this morning for the long journey from England.

I just want to ask Professor McCollum one question, and that is whether in his observations on the children he told us about this morning he included any treatment in connection with rickets. whether the rickets which were obvious in some children cleared up with the treatment by use of milk, and whether there are photographs showing this.

Doctor McCOLLUM. The demonstration of which I spoke was carried on about four years ago. We were limited as to funds, and it was only with difficulty that we secured any medical cooperation in the work, because that could be had only if paid for. Our medical observations on these children were, therefore, limited to a single systematic examination at the close of the demonstration by Doctor Ayd. It did not include any observations on the improvement of rickets in any of the children. Our observations were limited to the growth response, where that existed, and to the behavior of the children.

One of the striking things about the whole experience is that the children of this institution were very well-behaved. Discipline had never been a problem. They were meek, inactive, lethargic. Within a few weeks after we began our demonstration those in the group who were given the whole-milk additions to the diet began to be active and made some trouble for their teachers. This change in their behavior was as striking as any feature of the demonstration.

I regret now after four years, when we know so much more about rickets than we did at that time, when we gave so much attention to every detail we could take care of at that time, that more accurate observations on the bones of these children were not made.

Chairman CUMMING. Is there any further discussion?

Prof. ROBERT WALLACE (University of Edinburgh, Scotland). I visited India in 1879. I am sorry to hear there is no greater improvement in the natural supply of milk in that country. It was then carried about in kerosene cans from one place to the other. There has been a movement in the breeding of cattle there. It has been found that the Ayrshire breed mixes particularly well, although I want you to understand that I do not wish to advertise Ayrshire in preference to Holstein, but experiment has shown that the breed mixes very well with the cattle of India. The cattle of India, being exposed to the strong sunlight, have black skins. That is the great difference between the cattle of India and the cattle of European countries. That gives them health, which should enable them to produce good milk, if it is kept clean. European cattle have only half the strength of the cattle of India.

A man by the name of Smith has had control of dairy breeding in India and he has begun to develop this product of dry milk with the greatest of success. I am also glad to tell you that they have determined to sell a great deal of dry milk to Europe to help make up the deficiency of our supply of milk in the home.

The people here are all wrong in trying to breed white cattle. The hair of Ayrshire cattle is brown. They are not white cattle at all. When I was a boy there was not a single white animal in a hundred dairy cows. You are beginning to make the same mistake with your Holsteins as with your Ayrshires. They can not resist the effect of the sun if they are white. You will have animals that will blister in the sun and will be unable to give you the best quality of milk.

Chairman CUMMING. Sir Arnold Theiler, director of veterinary research in the University of South Africa, has now arrived, and I am sure he can give us some information in connection with these papers.

Sir ARNOLD THEILER. In connection with these various experiments which have been detailed in the papers read by these distinguished men, one thing has been overlooked, which I wish to mention which we in South Africa have for the last few years found to be one of the most important points in nutritional values, and to which we have given much attention. That is the supply of phosphorus. South Africa is very peculiar in the respect that the climate is dry. A large part of the country suffers from drought, this fact making it difficult to grow and develop food properly. As a result of this the cattle have a depraved appetite, which results in phosphorus deficiency and they develop a disease involving paralysis of the loins. If we supply the necessary phosphorus, not only the craving is appeased, but the animal changes entirely in its constitution. We grow a bigger animal and an animal with a better skin, a cow which produces more milk. These are things which in modern experiments on the Continent and in this country have been more or less neglected or overlooked. At this time, when so much is mentioned about nutrition, we should think of the mineral elements

Chairman CUMMING. Is there any further discussion?

Doctor MCCOLLUM. I want to say a few words in appreciation of the very excellent paper presented by Doctor Bloch, of Copenhagen. He is one of the most eminent pediatritians in the world, and his paper deserves special mention. As a pediatritian he was able, through very close study of the conditions which he encountered among the children of Denmark, to arrive at conclusions as to the cause and treatment of a disease of obscure origin in children. His observations were independent in great measure, although not entirely so, of the illumination shed upon the whole subject of nutrition in recent years by animal experimentation. His work on the eye diseases resulting from certain dietary faults is one of the great researches relating to human nutrition. It will always remain one of the classics of medical research.

Chairman CUMMING. I am sure we all regret very much that Doctor Pirquet was not able to be present. I know you will be glad to hear he has accepted a chair in the University of Minnesota.

(Adjournment.)

(Papers read by title):

MILK AS A STANDARD OF NUTRITION.

CLEMENS PIRQUET, Ph. D., professor and director, children's clinic, University of Vienna, Vienna, Austria.

1. A " nem " is a nutritive, combustible value of 1 gram of average human milk. The name is composed of the initials of "Nahrungs-Einheit-Milch," or " nutrition equivalent milk," and refers to a standard human milk of 1.7 per cent of protein, 3.7 per cent of fat, 6.7 per cent of milk sugar, as well as to a standard cow's milk of 3.3 per cent of protein, 3.7 per cent of fat, 5 per cent of milk sugar.

2. In spite of the great variations of the content of solids in the milk, we are entitled to take a certain theoretical average as a standard, just as we use the horsepower as a standard for our machines, disregarding the fact that every individual horse has a different power.

3. The standard milk chosen has a simple relation to the caloric system, having 667 small available calories in 1 gram, or 667 large calories in 1 kilogram; 2,000 small calories (therefore, 2 large calories) equal 3 nems, or one large calorie equals 1.5 nems.

4. This milk unit is used as a metric unit, and is combined with the Latin prefixes for metric fractions, and with the Greek prefixes for multiples of the unit:

A decinem means one-tenth of a nem, or the nutritive value of 1 decigram of milk, 0.1 gm., and is written 1 dn. A centinem is written 1 cn., and represents 0.01 gm.

These smaller units are used only in the calculation of the food intake per square centimeter in its relation to the nutritional surface.

In the practical use of foodstuffs we have to make use of the larger units namely, the multiples with Greek prefixes: A dekanem (dn.) means 10 nems; a hektonem (hn.) means 100 nems. This unit is used in the composition of a recipe for a certain dish, or of the day's program for one person or family. A kilonem (kn.) means 1,000 nems. We use it in buying foodstuffs for a family, or making recipes for a large number. A tonnenem (tn.), finally, represents the food value of 1 metric ton of milk: 1,000 kn., or 1,000,000 nems. We use it in community nutrition.

5. The food values of all articles used for human food should be determined by substituting a given quantity of the article for milk. Meantime we use a chemical analysis of the food, discount the per-

centage of combustibles lost in the urine and in the feces, and translate grams and calories into nems.

To shorten the chemical analysis I devised simple methods of examination, based on the testing of dry substances, fat, and ashes, which are easy to apply, and give results that are satisfactory for practical use.

6. The nem values of some of the most important foodstuffs are given in the following table, which gives at the same time the weight of 1 hektonem in grams: If 1 gram of flour has a food value of 5 nems, 20 grams will contain 100 nems, or 1 hektonem. The "hektonem weight" of flour, therefore, is 20.

Nems in 1 gram.		Hektonem weight.
13.5	Pure fat, oil	7.5
12	Butter	8.5
13	Bacon	10
6	Sugar, cocoa	16.7
5	Wheat flour, oat flour, biscuit, rice, ham, fresh fat meat, cheese, sirup, honey	20
4	White bread	25
3.5	Dark bread	30
2.5	Fresh meat, eggs	40
1.25	Potatoes	80
1	Milk, green peas	100
0.67	Fresh fruit	150
0.5	Skimmed milk	200
0.4	Turnips, spinach, cabbage, cauliflower, fresh mushrooms	250
0 2	Lettuce, cucumbers	500

Further details are explained in "An Outline of the Pirquet System of Nutrition," 4 vols., Saunders Co., 1922.

SESSION 10. ICE CREAM PROBLEMS.

Honorary chairman, Dr. A. Miyawaki, professor, Hokkaido University, Sapporo, Japan.

Chairman, F. N. Martin, president, Hazelwood Co., Ltd., Spokane, Wash.

Secretary, H. F. Judkins, professor of dairying, Massachusetts Agricultural College.

Y. W. C. A. Assembly Hall,
Syracuse, N. Y., Saturday, October 6, 1923—9.30 a. m.

Chairman Martin. It gives me great pleasure at this time to introduce the honorary chairman of this session, Prof. A. Miyawaki, from the Hokkaido University, Sapporo, Japan.

Honorary Chairman Miyawaki. I feel honored to act as the honorary chairman at this session, and thank you for the honor and opportunity to meet you here.

I do not want to take too much time to speak to you, because we have many excellent papers to hear. If, however, you allow me, I should like to say a few words about the dairying in Japan.

As you know our history dates back long before Christ. Agriculture was the chief occupation among our people from the very beginning, and yet, dairying is a very new thing in Japan. It may be said that there was practically no dairying, and no milk was used, a half century ago. Just about that time, condensed milk was imported to feed babies and invalids. Year after year, the demand for condensed milk increased, together with the demand for city milk and butter. The Government realized this and encouraged dairying by importing purebred cattle from abroad.

As this is the session on ice cream, I should not talk too much on the subject not pertaining to ice-cream problems. The ice-cream industry is just starting in my country, but not to such an extent as to make any definite report. Since my arrival in this country, you were so kind and generous as to let me go through many of your ice-cream plants, and I am astonished by the greatness of the industry. Your statistics show that about 3.5 per cent of your 10,000,000,000 pounds of milk produced in a year go into ice cream. This means about 350,000,000 pounds of milk are used for ice cream, and also means that is about twice as much milk as is produced in Japan in one year.

About 15 years ago, when I was in this country studying dairying, ice-cream making was still a trade secret. The ice-cream industry must have been developed in the last 10 or 15 years to its present magnitude. In 1910, I had the privilege of hearing a lecture on " Lacto " by Professor Mortensen at the Graduate School of Agriculture held at Iowa State College. If my understanding is correct, the first comprehensive course was offered by Professor Mortensen. There is no man better qualified than Professor Mortensen to talk on the development of the ice-cream industry in the United States.

Now, I have a great pleasure in introducing to you a man of whom I think a great deal, Prof. M. Mortensen, head of the dairy department of Iowa State College.

MEANS BY WHICH THE ICE-CREAM INDUSTRY HAS BEEN DEVELOPED IN THE UNITED STATES.

MARTIN MORTENSEN, head of dairy department, Iowa State College of Agriculture, Ames, Iowa.

After receiving this introduction I have very little to tell you. Our honorary chairman suggested that we were the first people to teach ice-cream making. You will notice from this paper that we were not first.

Although no definite information as to when ice cream was first made is available, it has been known for centuries in the European countries. The general belief is that it was first made in Italy and the inventor is said to have been an Italian dairyman. It is supposed that the idea of making frozen products was brought from Italy to France by Catherine de' Medici about 1550. More definite records of the use of ices in France date from the establishment of the Café Procope, about 1660, by an Italian from Palermo named Procopio Cultelli or Coltelli. Ice cream was probably introduced into England from France. The earliest printed record of ice cream in England is found in The Experienced English Housekeeper, by Elizabeth Raffald, published in London in 1769.

Ice cream was first sold in New York by a Mr. Hall, at 75 Chatham Street, now Park Row. It was introduced to the city of Washington by Mrs. Alexander Hamilton at a dinner at which President Washington was present. The first advertisement of ice cream appeared in a New York paper, the Post Boy, June 8, 1786.

Although ice cream had been known for centuries in Europe, the idea of commercializing it as a big industry was conceived by Jacob Fussell, who started a wholesale ice-cream business in Baltimore in 1851; in 1856 Mr. Fussell established a similar business in Washington, D. C.; in 1892 he erected a third plant in Boston; and in 1864 he started a business in New York City.[1]

TABLE 1.—*Early history of the ice-cream industry in the United States.*[a]

State.	Year when ice cream was first manufactured commercially.	Name of party first introducing commercial ice cream.
Pennsylvania [b]	1800	Mr. Bosio, an Italian confectioner, Germantown.
Maryland	1851	Jacob Fussell, Baltimore.
Missouri	[c] 1860	Perry Brazelton, St. Louis.
Utah	1860	John R. Clauson, Salt Lake City.
Massachusetts	1862	Jacob Fussell, Boston.
Ohio	1862	J. T. Rausley, Cincinnati.
New York	1864	Jacob Fussell, New York City.
Minnesota	1874	Tinkelpaugh Ice Cream Co., Minneapolis.
Colorado	1880	G. G. Carlson.
Connecticut	1880	C. J. Huber, Bridgeport; or John Semon, New Haven.
Georgia	[c] 1880	

[a] The information contained in this table was furnished by the dairy professors of the respective States.
[b] This was a retail plant and no ice cream was sold at wholesale.
[c] About.

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[1] For further information in reference to the early history of ice cream I would refer to an article published by Frank M. Buzzell in the Ice Cream Trade Journal, March, 1909, entitled "Origin and development of the ice-cream industry." An article on "The ice-cream industry" was published in the same journal, June, 1922, by Thomas D. Cutler.

TABLE 1.—*Early history of the ice-cream industry in the United States*.—Con.

State.	Year when ice cream was first manufactured commercially.	Name of party first introducing commercial ice cream.
Indiana	1880	Collins Ice Cream Co., Huntington.
Kansas	1882	Nicholas Steffen, Wichita.
Illinois	1885	Bloc Bros., Chicago.
California	1886	Carter Bros., Napa.[d]
Iowa	1890	F. D. Hutchinson, Sioux City.
New Mexico	1894	J. E. Mathews, of Mathews Dairy Co., Albuquerque.
Texas	1897	Mr. Boecleker, Dallas.
Kentucky	[c] 1898	
Arkansas	1900	Little Rock Dairy Co., Little Rock.
North Dakota	1900	Geo. Pirie Co., Fargo.
Montana	1902	A manufacturer in Butte.
South Dakota	1903	Ward-Owsley Co., Aberdeen.
Nevada	1908	Harry Chism.
Delaware	[d] 1915	Middletown Farms Dairies, Middletown.

[c] About.

[d] Shipped by express as far as 125 miles.

TABLE 2.—*Consumption of ice cream in the United States, by years*.[1]

Year.	Quantity.	Year.	Quantity.
	Gallons.		*Gallons.*
1909	80,000,000	1916	208,320,000
1910	95,450,000	1917	219,385,000
1911	138,000,000	1918	231,053,000
1912	160,000,000	1919	248,381,975
1913	172,380,000	1920	257,820,490
1914	163,761,000	1921	216,569,212
1915	175,224,270	1922	263,520,000

[1] Figures obtained from Ice Cream Trade Journal and United States Department of Agriculture.

It will be noted from Tables 1 and 2 that the ice-cream industry has spread with great rapidity throughout the entire United States, until at present ice cream is served on the tables of poor and rich alike. When an industry develops at a tremendous rate there is usually a combination of factors responsible. This holds true with reference to the ice-cream industry, and the following factors may be considered as those having the most direct bearing on its development:

1. The progressive and aggressive attitude of the ice-cream manufacturers.
2. The rapid development and improvement of machinery and equipment.
3. Trade papers and books.
4. State agricultural colleges.
5. State agricultural experiment stations.

THE ICE-CREAM MANUFACTURER.

Most of the earlier manufacturers of ice cream started with limited capital, but what they lacked in money was more than compensated for by their unlimited confidence in the industry, and as they were located in the cities they had an opportunity to exchange ideas with men of large affairs, and in that way they learned to employ the methods of large business. Many of the manufacturers took less interest in the financial returns that in conducting a business which would aid in creating more happiness among people in general, and that spirit in connection with sound business principles is bound to win. If we visit an up-to-date ice-cream factory to-day we find it equipped with the most modern machinery and often with bacteriological and chemical laboratories in which research is being carried on.

The ice-cream manufacturer, in his effort along the line of expansion, has received considerable assistance from men who were not directly engaged in the ice-cream business. The invention of the cornucopia, or ice-cream cone, increased the sale of ice cream materially. The ice-cream cone first made its appearance at the World's Fair in St. Louis in 1904. At that time the Hazelwood Creamery Co. arranged for the exclusive right to manufacture the cone at the Lewis and Clark Exposition to be held the following year in Portland, Oreg. Since then the cone has become known in every town in the United States. The Eskimo pie, invented by C. Nelson, Waukon, Iowa, appeared in October, 1921. This also has stimulated the demand for ice cream.

It would be unfair to close this chapter without giving due credit to the commercial travelers who deal directly with the ice-cream manufacturers. These men have, from the beginning of the industry, stood back of the ice-cream manufacturers and given their encouragement and support whenever possible.

DEVELOPMENT AND IMPROVEMENT OF ICE-CREAM MACHINERY AND EQUIPMENT.

Mr. F. D. Hutchinson, the pioneer in the ice-cream business in Iowa, writes: "I remember the Fourth of July of 1890 we shipped out nearly 300 gallons, all frozen by hand power." Had the hand-power freezer continued little progress could have been looked for, but fortunately the old tub freezer was soon connected to a line shaft with a resulting expansion in business. A great step forward was made in 1902–3, when the Miller brine freezer was developed. This was followed soon afterwards by a similar freezer known as the Miller-Tyson freezer, and at present there are several makes of that type on the market.

The mechanical system of refrigeration was first successfully used for commercial enterprises in 1861, but it did not find a place in the ice-cream industry until after the introduction of the brine freezer. The hardening of ice cream with brine was simultaneously introduced. This system of hardening was soon almost wholly replaced by the present dry-air system, which is not merely a saving in labor but also is the most sanitary method of hardening known up to the present time.

The homogenizer, a machine which is essential in a modern ice-cream factory, was invented by August Gaulin, of Paris, France, in 1902. The United States Letters Patent were dated April 12, 1904. By the aid of this machine the texture of the ice cream has been greatly improved.

Other pieces of equipment which have added to the completeness of the ice-cream factory are the Mojonnier milk tester, introduced to the trade in 1915; the Mojonnier ice-cream overrun tester, introduced in 1917; the 80-quart ice-cream freezer, introduced by the Creamery Package Manufacturing Co. in 1917; the Mojonnier ice-cream packaging machine, which appeared in 1920; and the Sealright ice-cream filling machine, 1920.

TRADE PAPERS AND BOOKS.

The Ice Cream Trade Journal made its appearance in 1905 and was followed by the Ice Cream Review in 1916. In addition to these, several journals such as the International Confectioner and some of the dairy journals have devoted space to the manufacture of ice cream. The ice-cream publications have kept up to a high standard, and by presenting high ideals as well as technical knowledge, have done their share in bringing about rapid progress in the ice-cream industry.

In 1883 an interesting book entitled "Ice Cream and Cakes" was copyrighted by Chas. Scribner's Sons, New York. The author evidently feared criticism, as he signed himself "An American." It is true that he was not in possession of the scientific facts which are available to-day, yet he was well informed and a great deal ahead of the ice-cream manufacturers of his time. Later books were published by manufacturers. These are Ice Cream and Candy Maker's Factory Guide, by the Horizontal Freezer Co., of Chicago; Heller's Guide for Ice Cream Makers, by B. Heller & Co., Chicago; and Bottler's and Ice Cream Maker's Handy Guide, by Warner-Jenkinson Co.

The first college textbook giving instruction in the manufacture of ice cream was "Dairy Technology," by Prof. C. Larson and Wm. White, published by John Wiley & Sons in 1913. This was followed by a textbook dealing exclusively with the manufacture of ice cream and ices by Prof. J. H. Frandsen and E. A. Markham; it was published by the Orange Judd Co. in 1915. The latest book on the subject is entitled "The Book of Ice Cream," by Prof. W. W. Fisk, and was published by the MacMillan Company in 1919.

THE STATE AGRICULTURAL COLLEGES.

Instruction in ice-cream making was offered as early as 1892 at the Pennsylvania State College. The Iowa State College was the next one to offer such instruction, but not until 1901. After that the other State colleges followed in rapid succession, until ice-cream manufacture is to-day offered in 30 State colleges which give fairly thorough and scientific instruction to from 600 to 700 students annually. In addition, many of our colleges are offering short courses in ice-cream making, from one to two weeks in duration; and most of them are also giving some ice-cream instruction in the general and more elementary courses offered to all agricultural students. It is evident that this work has been of some importance to the industry, as improvement in the technique can be made only by men of thorough technical training.

TABLE 3.—*College instruction offered in the manufacture of ice cream.*

State colleges.	Year when instruction was first offered in the manufacture of ice cream.	Present enrollment of students in courses in ice cream.
Alabama Agricultural College	1922	25
Arizona Agricultural College	1918	10
University of Arkansas	1920	....
University of California	1913	60
Connecticut Agricultural College	1917	30
Georgia State College of Agriculture	1916	15
University of Idaho	1908	13
University of Illinois	1913	....
Purdue University, Indiana	1911	25
Iowa State College	1901	58
Kansas State Agricultural College	1904	20
University of Kentucky	1921	11
University of Maryland	1923	10
Massachusetts Agricultural College	1914	....
University of Minnesota	1913	35
Mississippi Agricultural College	1920	21
University of Missouri	1915	30
University of Nevada	1914	3
New Hampshire College of Agriculture	1912	24
Cornell University, New York	1910	46
North Dakota Agricultural College	1917	None.
Ohio State University	1910	15
Oregon Agricultural College	1909	16
Pennsylvania State College	1892	68
South Dakota State College	1908	16
Texas Agricultural College	1921	18
Utah Agricultural College	1922	12
University of Vermont	....	15
State College of Washington	1906	10
University of Wisconsin	1910	50

THE AGRICULTURAL EXPERIMENT STATIONS.

Nineteen agricultural experiment stations and the Dairy Division in Washington, D. C., report that they are carrying on experimental or research work on problems related to the ice-cream industry. These stations are as follows: California, Connecticut, Idaho, Illinois, Indiana, Iowa, Kansas, Maryland, Minnesota, Mississsippi, Missouri, New York, Pennsylvania, Texas, Utah, Vermont, Virginia, Washington, and Wisconsin.

It is natural that experiment-station bulletins published on problems related to the ice-cream industry are as yet not very numerous; it can be said, however, that we have made a good start and such publications will doubtless become much more numerous in the future.

The Government and experiment-station bulletins published up to date are:

Dairy Division, United States Department of Agriculture.

Department Bulletin 303. A bacterial study of retail ice cream, 1915.

Department Bulletin 563. The determination of bacteria in ice cream. 1917.

Department Bulletin 1123. Proportioning the ingredients for ice cream and other frozen products by the balance method. 1922.

Department Bulletin 1161. Effect of composition on the palatability of ice cream. 1923.

Reprint from Journal of Agricultural Research, Vol. XXI, No. 10.

Sandy crystals in ice cream; their separation and identification. 1921.

Vermont Agricultural Experiment Station.

Bulletin 155. Principles and practice of ice cream making. 1910.

Wisconsin Agricultural Experiment Station.

Bulletin 241. An ice cream overrun test. 1914.
Bulletin 262. Ice cream making. 1916.

Illinois Agricultural Experiment Station.

Circular 219. Conserving sugar in ice cream manufacture. 1918.
Circular 256. Does carbon dioxide in carbonated milk and milk products destroy bacteria? 1922.

Nebraska Agricultural Experiment Station.

Bulletin 168. Sugar saving substitutes in ice cream. 1918.

Connecticut Agricultural Experiment Station.

Bulletin 83. The bacterial content of ice cream. 1915.

New York Agricultural Experiment Station.

Memoir 18. A study of bacteria in ice cream during storage. 1919.

Virginia Agricultural Experiment Station.

Technical Bulletin 7. Smoothness and keeping qualities of ice cream as affected by solids. 1915.
Bulletin 211. Effect of binders upon the melting and hardness of ice cream. 1916.

Iowa Agricultural Experiment Station.

Bulletin 123. Classification of ice cream and related frozen products. 1911.
Bulletin 118. Lacto. 1911.
Bulletin 134. Bacteria and ice cream. 1912.
Bulletin 140. Lacto, a frozen dairy product. 1913.
Bulletin 174. Bacteria in ice cream. 1917.
Bulletin 180. Factors which influence the yield and consistency of ice cream. 1918.
Bulletin 186. A bacterial study of the method of Pasteurizing and homogenizing the ice-cream mix. 1919.

The Journal of Dairy Science, a publication of the American Dairy Science Association, first appeared in 1917. This journal has published several articles relating to the ice-cream industry; the data presented in these are usually the result of work carried on in some of the experiment stations.

Scope of work considered by the experiment stations.—The first bulletin published on ice-cream making, Bulletin No. 155, Vermont Station, was naturally very general. It gave a complete discussion of the general methods of ice-cream making and was based on valuable experimental data. This bulletin was so complete that it was even used as a textbook in some of the colleges. The first experimenters naturally sought to establish some of the fundamentals. They invariably presented a score card for ice cream and a classification.

Several score cards have been suggested for ice cream, but none of these were approved by the American Dairy Science Association, and in 1920 that organization appointed a committee to prepare an official score card. The following score card was recommended by that committee and was adopted as the official score card, October 11, 1921:

Flavor	40
Body and texture	25
Fat and solids	10
Bacteria	20
Package	5
Total	100

It is recommended in Bulletin No. 155, Vermont, that ice cream may be classified as, first, plain ice cream, frequently known as Philadelphia, and second, French, or Neapolitan, ice cream, which differs from the first in that it contains eggs. Iowa Bulletin 123 contains the following classification:

I. Plain ice creams.
II. Nut ice creams.
III. Fruit ice creams.
IV. Bisque ice creams.
V. Parfaits.
VI. Mousses.
VII. Puddings.
VIII. Aufaits.
IX. Lactos.
X. Ices.
  1. Sherbets.
  2. Milk sherbets.
  3. Frappés.
  4. Punches.
  5. Soufflés.

Prof. W. W. Fisk, in his textbook entitled "The Book of Ice Cream," combines the two, and has proposed a very sensible classification. An official classification should be adopted by the American Dairy Science Association.

MANUFACTURING METHODS.

Certain facts concerning the manufacture of ice cream have been reasonably well established. It has been determined without doubt that there is a rather definite relationship between the composition and the palatability of ice cream. The conclusions reached in the experiments carried out by the Dairy Division are in harmony with results obtained by a commercial concern conducting experiments along similar lines. It should therefore be understood that it is not possible to make a really palatable ice cream without making it from cream. Ice cream has been standardized reasonably well and contains usually from 20 to 22 per cent milk solids. The sugar is somewhat more variable, ranging from 12 to 16 per cent in different brands of ice cream.

Body and texture defects of ice cream have been studied and to some extent solved. It has been definitely proven that sandiness in ice cream is due to the crystallization of lactose from a supersaturated solution. It has been found that there is a somewhat definite relationship between the temperature at which the ice cream is drawn from the freezer and the texture and yield of the resulting product. The time required for freezing bears a similar relationship to the texture and yield.

By increasing the viscosity of the mix, especially by the addition of binders and by homogenization, the air can be worked into the ice cream in a finer state of division. Therefore the mix becomes more finely divided and the ice crystals in the finished product are decreased in size correspondingly. The body of the ice cream also becomes firmer and stronger as the pressure within the air cell increases with the decrease in the size of the cell.

In unpublished work done at the Iowa State Experiment Station it has been found that the greatest factor responsible for the increase in viscosity by homogenization is the clumping together of the fat globules. As the pressure of the homogenization is increased the fat clumps increase in size and there is a somewhat corresponding increase in viscosity. It has been found that if an ice-cream mix homogenized at a higher pressure is stirred or agitated the clumps of fat globules are reduced in size, and this is accompanied by a corresponding decrease in viscosity.

The data that have been secured on the bacteriology of ice cream show that this product frequently contains excessive numbers of bacteria, but by using suitable raw materials and careful methods the counts can be kept low and will remain low during proper storage. The investigational work at present being done deals mainly with the question of the sanitary quality of the product. Bacterial standards are in force in a few cities and will undoubtedly be much more common in the near future. With the establishment of such standards the factors influencing the bacterial count become highly important; chief among these are, the quality of the raw materials used, the pasteurization of the cream or mix, the storage of the cream or mix, methods of cleaning equipment, and the holding of ice cream. The bacteriology of ice cream is comparatively simple and involves keeping out microorganisms as much as possible and the destruction or prevention of growth of those that do gain entrance.

The ice-cream field offers great opportunities for future research, but the person choosing that field should be well trained, especially in physical chemistry. The field for the bacteriologist and dairy chemist is somewhat limited; most of the future problems will be physical and there should be a wonderful opportunity for the man possessing the necessary qualifications to develop that phase of our dairy research.

SUMMARY.

It is the general belief that ice cream was first made in Italy. It was possibly introduced into France about 1550. The earliest printed record of ice cream in England is found in the Experienced English Housekeeper, published in 1769. The first advertisement of ice cream in the United States appeared in a New York paper, the Post Boy, June 8, 1786. The first wholesale ice-cream business was started by Jacob Fussell in Baltimore in 1851.

The ice-cream business increased in the United States from 80,-000,000 gallons in 1909 to 263,529,000 gallons in 1922. The factors responsible for this remarkable progress may be summarized as follows: (1) The progressive and aggressive attitude of the ice-cream manufacturers. (2) The rapid development and improvement of machinery and equipment. (3) Trade papers and books.

(4) State agricultural colleges. (5) State agricultural experiment stations.

The ice-cream industry has been developed by men who have employed sound business principles; they have occasionally received help from outside sources. The ice-cream cone, 1904, aided in increasing the sale of ice cream, as did also the Eskimo pie.

The greatest advance in ice-cream machinery was made in 1902–3 with the introduction of the horizontal brine freezer. This was followed by the introduction of the homogenizer and other machinery at present found in an up-to-date ice-cream factory.

The Ice Cream Trade Journal, the first trade paper in the ice-cream field, was started in 1905, and was followed in 1916 by the Ice Cream Review. The first college textbook giving instruction in the manufacture of ice cream was Dairy Technology, by C. Larson and Wm. White, 1913. The first textbook dealing exclusively with the manufacture of ice cream was written by J. H. Frandsen and E. A. Markham, 1915. This was followed in 1919 by The Book of Ice Cream, by W. W. Fisk.

The Pennsylvania State College offered instruction in ice-cream making as early as 1892. At present instruction in ice-cream making is offered by 30 State agricultural colleges that give fairly thorough and scientific instruction to from 600 to 700 students annually.

Nineteen State agricultural experiment stations and the Dairy Division in Washington, D. C., carry on experimental or research work on problems related to the ice-cream industry. The first bulletin on the subject of ice-cream making was published by the Vermont Agricultural Experiment Station in 1910. At present 22 experiment station publications are available on the subject.

The problems that have been investigated up to the present time are mainly those related to flavor, texture, and bacteriology. It has been definitely determined that there is a relation between the composition of ice cream and the flavor and texture. Several defects in ice cream have been studied and remedies suggested. The relationship of viscosity to texture has been studied to some extent. Many bacterial analyses of ice cream have been made and methods of reducing the number of bacteria suggested.

Chairman Martin. I think you will all agree Mr. Mortensen has delivered us a very valuable paper.

Our next paper is one by Mr. William White, dairy manufacturing specialist, United States Department of Agriculture, on "The preparation of standardized mix in country plants."

THE PREPARATION OF STANDARDIZED MIX IN COUNTRY PLANTS.

William White, dairy manufacturing specialist, Dairy Division, United States Department of Agriculture.

In some parts of this country there are creameries receiving large quantities of milk that are equipped to manufacture several or all of the standard dairy products, such as sweet cream, butter, plain or sweetened condensed milk, skim milk powder, American cheese, cottage cheese, and casein.

At these plants the milk is turned into the products that are most profitable at the time or those which the market conditions require. In recent years some plants have included in their list one additional product, and that is standardized ice-cream mix. This has become a commercial product only in the past few years since we came to realize the importance of having mix exactly standardized in composition.

The product is so new that practically no statistics have been compiled to show how much is made. New York State has production figures on mix for the past two years, and Wisconsin plans to include the item this year. Standardized ice-cream mix has found a demand in certain trades, and its use is increasing as it becomes better known.

One of the problems of the ice-cream manufacturer is to have a supply of raw material adequate in quantity and satisfactory in quality. Because the demand for ice cream varies greatly from season to season and even from day to day, the milk and cream requirements of the ice-cream manufacturer vary greatly. The production of milk and cream and therefore the available supply bears little relation to the needs of the ice-cream trade. For example, ice-cream production in July may be two and one-half times as much as in April, while milk production in July may be only one and one-fifth as much as in April. If the ice-cream manufacturer can arrange to procure raw material in just the quantity he requires at all times without paying too dearly for the service the situation is ideal.

The large manufacturer frequently finds it desirable to purchase milk and cream direct from the producer, often having country plants for this purpose. During a part of the year, he has a surplus to be sold or manufactured into other products; another season he may find it necessary to supplement his regular supply by purchases from plants that may be in a position to serve him. His raw materials usually are shipped from his own country plant or from other creameries and condenseries, as needed, to his city plant where the mix is made and frozen.

Several large companies that have more than one manufacturing plant have adopted the practice of making all their mix at one plant and shipping it to the other plants to be frozen. The advantage of this is they are able to reduce their technical force somewhat and they obtain a greater uniformity of product at their different plants.

The small manufacturer who buys his raw material direct from the farmer frequently has difficulty in procuring an additional supply when needed and also difficulty in disposing of a surplus of milk or cream without financial sacrifice.

The demand for standardized ice-cream mix is, to a large extent, from the smaller ice-cream manufacturers or retailers who make their own product. The possible outlet even among small manufacturers is very large because, although there are many plants making more than 500,000 gallons of ice cream a year, there are several times as many that make less than 50,000 gallons.

In the State of Michigan, according to the annual report of the State bureau of dairying for the fiscal year ending June 30, 1923, the plants that make 50,000 gallons or less a year are 85.1 per cent of the total number of plants in the State. In this connection, however, it is well to note that this large number of plants make only 18.36 per cent of the total quantity of ice cream made in the State.

The purchasing of standardized ice-cream mix appeals to the small manufacturer; first, because it solves his problem of a supply of raw material; second, because it relieves him of the labor and difficulty of making his own mix, as proper facilities are often lacking for this purpose; and, third, because it enables him to have a homogenized mix of uniform quality. Many small manufacturers, either through lack of knowledge or lack of equipment, are unable to prepare a standardized mix, their greatest difficulty being in standardizing the percentage of solids not fat. In purchasing a standardized mix the manufacturer obtains not merely a mixture of cream, milk, and sugar, but also the services of the technically trained man who prepared the mix and the services of the high-priced equipment used in its preparation. He receives a mix that, when properly frozen, has the same body and texture as the product of his large competitor.

Too often the small manufacturer makes his mix by guess, and the percentage of fat and solids not fat varies several per cent from one day to another. He does not have a homogenizer or viscolizer because the first cost looks too big. As a consequence, the texture of his product may be far from ideal.

There are some objections offered by the ice-cream manufacturers to using mix made by another company. One is that the mix may not always be the same; that is, there is a lack of confidence in the firm; and it is unfortunately true that so-called standardized mix has been sold by irresponsible firms, that was of poor quality and therefore caused dissatisfaction. To some extent this has hurt the sale of mix by responsible firms. In the writer's experience, mix of 36 per cent solids was sold to a number of small manufacturers and they reported they could not get much swell, and therefore would not continue to use it. Upon investigation it was found that old-style freezers were being used and the brine supply was inadequate. It was, therefore, necessary for them to have a light mix in order to obtain a satisfactory swell. One manufacturer complained that the mix made a slimy ice cream. He had not been using homogenized or viscolized mix and had been making a coarse-grained product. When he started to use the homogenized mix the contrast in the texture was so great he thought the latter was too smooth. To overcome this he mixed in some unhomogenized mix to produce the texture he desired. So it seems that when selling mix it is a hard matter to please all customers.

The country plant making mix to sell will meet with complaints like these and probably many others. To avoid just complaints it is of course necessary that a good mix be made, and this involves having a thorough knowledge of ice-cream manufacture, and making a product of high quality and absolutely uniform from day to day. One mix may be adopted as the standard that will be satisfactory to the majority of customers, but it may be found necessary to make up special mixes for larger customers who have their own ideas as to what they want. Country plants that are able to make standardized mix without too great an additional expense usually find it a profitable venture. Frequently, the only additional equipment needed is a homogenizer or viscolizer.

The greatest demand for mix comes at a time when the country plant has a large supply of milk and cream, so a market for mix can be taken care of without interfering with the year-round business they may have for other products. The ice-cream demand does, however, extend well into the season of small production and the plants going into the making of mix must take this into consideration when working up their business.

The relation between the percentage of fat and solids not fat in mix is such that if a certain quantity of whole milk is allotted to mix there will be a surplus of solids not fat to be utilized in some other product, or if the solids not fat are to be utilized wholly in mix, butter or cream may be obtained to maintain the proper balance.

Assuming a mix containing 12 per cent fat and 10 per cent solids not fat, 1,000 pounds of 4 per cent milk would contain enough solids to make 333 pounds of mix and leave 630 pounds of skim milk for other products. This extra skim milk is used to a large extent in making plain or sweetened condensed skim milk; some plants also make cottage cheese or casein.

June butter may be stored and used to supplement the supply of fat later in the summer. For instance, to make 1,000 pounds of mix requires a total of 120 pounds of butterfat; 1,111 pounds of milk supplies all the solids not fat needed and 44.44 pounds of fat. An additional 75.56 pounds of fat is needed and may be supplied by 89.95 pounds of butter containing 84 per cent fat.

Country plants that have engaged in the preparation and marketing of standardized ice-cream mix find in this product a satisfactory outlet for milk solids. Because this is a partly manufactured product and the processing of the material adds greatly to its value, the plant is enabled to obtain a price that nets a very satisfactory profit. Small manufacturers of ice cream and retailers who make their own product find it advantageous to purchase a ready prepared standardized ice-cream mix.

Chairman MARTIN. The next two numbers are papers by W. B. Combs and C. D. Dahle. Is either gentleman present?

MEMBER. May I say for Mr. Combs that he will not be here and unfortunately his paper has not reached me.

Chairman MARTIN. I have his paper right here. I thank you. These papers will be transferred to the end of the list.

The next paper, "Factors influencing the crystallization of lactose," by Alan Leighton, physical chemist, and P. N. Peter, assistant physical chemist, Dairy Division, United States Department of Agriculture, will be read by Mr. Leighton. Mr. Leighton.

FACTORS INFLUENCING THE CRYSTALLIZATION OF LACTOSE.

ALAN LEIGHTON and PHILIP NORMAN PETER, research laboratories, Dairy Division, United States Department of Agriculture.

From the dairy manufacturer's point of view, lactose is of interest from three angles: First, in its crystallization from whey; second, in its spontaneous crystallization from evaporated and condensed milks; and, third, in its crystallization from ice cream, creating the so-called sandy ice-cream problem.

The following paper deals with what may be termed pioneering experiments on lactose conducted from a number of different angles to obtain a basis for a well-ordered physical-chemical investigation of "sandy ice cream" and the separation of lactose from condensed milks. In this preliminary work a number of interesting facts have appeared which seem to be worth bringing out at this time. Most of the experiments were conducted with aqueous lactose solutions.

Lactose, or milk sugar, is present in milk in a quantity which exceeds that of any other single constituent except the water. It represents, to use Van Slyke's figures, 4.9 per cent of the total milk composition, or about 54.4 per cent of the milk solids not fat, or, to express the relationship in another way, there are present in normal milk 5.4 parts of lactose to 100 parts of water.

From a physical-chemical viewpoint lactose is interesting in that it exists in at least three forms, alpha (α) hydrate and anhydride and the beta (β) anhydride. The relationships of these three forms have been investigated by both Hudson (1) and Gillis (2). The normal product crystallized from water solution at ordinary temperatures is the so-called alpha hydrate. This is a hydrate of the alpha anhydrous modification. This anhydrous modification is metastable at all temperatures in the presence of water. When it is brought into contact with water it is almost instantaneously hydrated. At a temperature of about 93° C. there exists a transi-de-hydration point, as it is termed by Gillis, at which with rising temperature the alpha hydrate is completely changed to the anhydrous beta form.

If the hydrated alpha form is dissolved in water, a reaction takes place whereby some of the hydrate is changed to the beta anhydrous form. At any temperature below 93° C. an equilibrium is reached, when there is present in solution about 1 part of the hydrate to 1½ parts of the beta anhydrous modification. Thus, as has been clearly pointed out by Hudson, lactose can be said to have an initial as well as a final solubility. The initial solubility is the true solubility of the hydrate, while the final solubility is expressed by the total amount of hydrate plus the equilibrium quantity of the beta form which can exist in solution at a given temperature.

Equilibrium between the two forms in solution is attained but slowly at ordinary temperatures. Its attainment is very greatly accelerated by both hydrogen and hydroxyl ions. The percentages of lactose which are transformed in one hour are found to be:

	Per cent.
At 25° C	51.1
At 15° C	17.5
At 0° C	3.4

The equilibrium is attained instantaneously at 75° C.

Hudson's values for the initial and final solubilities of the hydrated form of lactose were used in compiling Table 1.

TABLE 1.—*Initial and final solubility of lactose.*

Initial.			Final.		
Temperature.	Lactose.	Parts of lactose to 100 of water.	Temperature.	Lactose.	Parts of lactose to 100 of water.
° *C.*	*Per cent.*		° *C.*	*Per cent.*	
0	4.7	5.0	0	10.6	11.9
15	6.6	7.1	15	14.5	16.9
25	7.9	8.6	25	17.8	21.6
39	11.1	12.6	39	24.0	31.5
49	15.1	17.8	49	29.8	42.4
64	20.7	26.2	64	39.7	65.8
74	25.6	34.4	74	46.3	86.2
89	35.8	55.7	89	58.2	139.2

The actual solution of the beta form is given by Hudson as 45.14 parts to 100 parts of water at 0° and 94.75 at 100° C.

Hudson has also pointed out that there will be two cryohydrate temperatures when the ice line for lactose solutions is cut by the solubility curves representing the initial hydrate solubility and the final hydrate solubility. The first temperature is minus 0.281° and corresponds to an initial hydrate solubility of about 5 parts of lactose to 100 parts of water. The second temperature is minus 0.65° and corresponds to a lactose concentration of 11.9 parts to 100 parts of water.

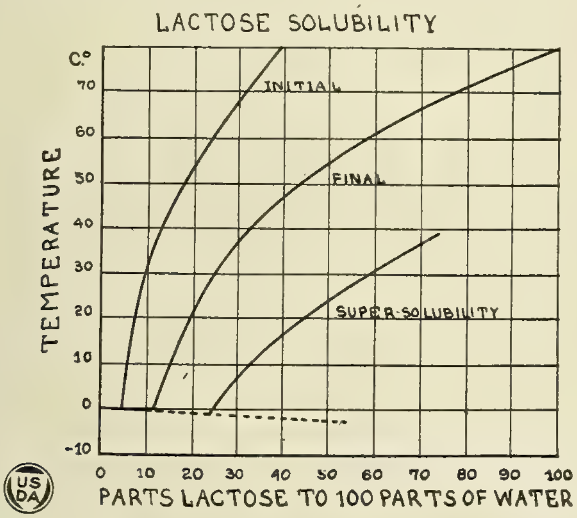

FIG. 1.—Initial, final, and super-solubility of lactose.

The ice line curve and the solubility curves of the initial and final hydrate equilibrium are given in the chart, Figure 1.

Since in this paper we shall confine ourselves to a rather general discussion of those factors which influence the crystallization of lactose from aqueous solution under ordinary conditions, we are not interested at this time in any further study of the physical-chemical relationships of the beta and alpha anhydrous milk sugar forms. We will therefore now pass to a survey of some of the more recent work on crystallization.

Hallimond (3) has given a most excellent exposition of the theories of crystallization with especial reference to the supersaturation theories. He points out that there are three main principles which must be taken into account in a theory of crystallization:

> The first concerns the existence, below the ordinary solubility curve for each constituent, of a range of temperature and concentration within which crystallization is only initiated upon the introduction of a suitable nucleus. The second is that the rate of growth of a crystal at first increases as the temperature falls below that of equilibrium (saturation) and then diminishes when a certain degree of supercooling is exceeded. The third is that the redistribution of heat and of dissolved matter, consequent on and essential to solidification at the surface of a growing crystal, is governed by gradients of temperature and concentration which depend in their turn upon the respective coefficients of heat conductivity and of diffusion.

To discuss a little more in detail, still following Hallimond's paper: Miers (4) and Ostwald (5) have shown that when supercooling of a solution takes place, the tendency to crystallize first increases with a drop in temperature and then diminishes again so that the material may be made to pass into an amorphous mass. They have also recognized that, with moderate supercooling, nuclei sometimes fail to appear even after many weeks' standing. Ostwald proposes the terms " metastable " for the condition wherein nuclei do not readily appear, and " labile " for that condition induced by a greater degree of supercooling wherein crystallization will, when once initiated, spread rapidly throughout the mass. It has been shown by Miers that under suitable conditions of experiment a very definite boundary line can be determined between the metastable and labile states. In the metastable state it is usually possible to induce crystallization only by a liberal seeding with the material itself or a substance which is isomorphous with it.

Experiments reported by Miers and Isaac (4) have shown that in this state it is also possible to have growing crystals which do not in turn cause a general separation. Another point of interest is that for each foreign substance there will be a characteristic temperature at which it is capable of initiating crystal growth. This means that if we plot a temperature concentration curve as showing the boundary between the metastable and labile states the actual position of this curve as compared with the normal solubility curve will vary definitely and characteristically with the addition of foreign substances to the system. This is an important point. Even in the labile state it must be pointed out that the time element is a factor. Crystallization may not take place even within this area. If crystallization does take place, time will often have to be allowed for it to proceed far enough to be observed, although frequently, when this state is encountered crystallization proceeds so rapidly that it has the appearance of being instantaneous. Hallimond emphasizes particularly that there is ground for regarding the true supersaturation or inoculation point as a definite limiting temperature, above which crystallization will not occur even on indefinitely slow cooling.

The linear crystallization velocity at first increases with supercooling, then remains constant, and finally diminishes more or less sharply with falling temperature; probably owing, in the first place, to the usual increase in speed of a reaction with departure from equilibrium, and, in the second place, to the increase of viscosity and diminution of reaction velocity with falling temperature.

The continued growth of a crystal is conditional on the maintenance of a supply of material by diffusion, and on the dissipation of the latent heat developed in crystallization.

Jones (6) in a paper upon the spontaneous crystallization of the alkali nitrates shows not only the supersolubility curve of the nitrates but what he calls the supersolubility of ice. In other words, he gives a curve below the normal ice curve which shows the highest temperatures at which spontaneous separation of ice will occur. The intersection of this superfreezing point curve and the supersolubility curve give a supercryohydric point. This point does not of necessity lie directly under the true cryohydric point. The composition of the solution at the supercryohydric point is therefore not of necessity the same as that at the true cryohydric point.

We can now proceed to a discussion of all these relationships in their bearing on the crystallization of lactose.

Since it has been shown above that the equilibrium ratio between the alpha hydrate and the beta anhydride in solution is practically constant regardless of temperature or concentration, it follows that, once equilibrium has been established in solution, temperature changes occurring at temperatures beneath the transition point, 93°, and above the final solubility curve will not materially affect the solution. But, when a solution is cooled slowly until the saturation point is reached, and crystallization starts, the hydrate will separate out. If the temperature is then quickly lowered a few degrees, an amount of lactose will separate out equal to the supersaturation of the solution with the hydrate. Some of the beta form will then be transformed to the hydrate, and hydrate will be deposited further at the rate at which this reaction proceeds. If this deposition takes place at very low temperatures where the rate of transformation is slow (at 0° C., it is only about 3.4 per cent in one hour), it is very evident that the crystallization process will not proceed rapidly unless the speed of this transformation be hastened with acids or alkalis. Of course, this is true only if the velocity of crystallization exceeds the velocity of transformation. Hudson has shown that this is the case. The rate of the equilibrium transformation may therefore be a factor in the time required to completely crystallize lactose from a given solution.

It is at once apparent, then, that the rate of the establishment of the alpha-beta equilibrium—which is less, the lower the temperature—will probably be a factor regulating the rate of separation whenever lactose crystallization occurs, be it from whey, from evaporated or condensed milk, or from ice cream. If it is desirable to eliminate this factor (which will be more important at lower temperatures), it can be accomplished by the introduction of the accelerating hydrogen or hydroxyl ions wherever possible. It seems as if the acidity would be an important factor in accelerating this equilibrium, particularly when we are dealing with the separation of lactose from whey.

Proceeding now to the laboratory work: In some preliminary experiments performed for the purpose of observing the actual crystallization of lactose, supersatured lactose solutions of varying concentration were rotated in closed bottles in a thermostat at about 20° C.

These solutions were seeded with one crystal of lactose of moderate size. It immediately became evident that only the very highly supersaturated solutions crystallized, while those of moderate supersaturation could not be made to crystallize in this manner. For instance, at 20° C. crystallization could be induced only by heavy seeding in a solution containing 30 parts of lactose to 100 parts of water, which solution from the solubility curve is shown to be saturated at about 38°. When seeded with one crystal and revolved in the thermostat for five days at 20° this solution showed no signs of crystallization, although the seeding crystal had grown slightly.

These experiments indicated that lactose solutions exhibit an extensive metastable area, and bearing in mind the crystallization theories of Hallimond quoted above, other experiments were conducted in the same thermostat wherein lactose solutions varying from one another by about 5 parts lactose to 100 parts water, were rotated in stoppered bottles as before. These bottles were seeded with bits of glass. The temperature of the bath was lowered a few degrees every 24 hours and note was made at that time of the bottles which had crystallized. In this way it was shown that the supersolubility curve of lactose lies in the neighborhood of 30° C. below the true solubility curve. The fact that these curves are separated to such an extent must be considered a very great factor in lactose crystallization, one which, so far as the authors know, has not been pointed out before. The position of the supersolubility curve of lactose is shown also in Figure 1.

These results have a practical bearing upon the separation of lactose from whey, evaporated and condensed milk, and ice cream. They show that the biggest factors controlling this separation are concentration, temperature, and seeding.

In the case of crystallization from wheys where the concentration is always very great, the lactose will always be in the labile state; any nucleus will induce crystallization and copious seeding should result in a rapid general crystallization.

With evaporated or condensed milks either condition may exist, but the milks will probably be in the labile state.

In this connection let us consider, for example, a condensed skim milk containing 48 parts of sugar, 26 parts milk solids not fat, and 26 parts water. The lactose is present in the ratio of 14.14 parts lactose to 28 parts water, or 50.5 parts lactose to 100 parts water. Barring the effect of the other constituents upon the solubility of lactose, this would be saturated with lactose at a temperature of 59° C. At room temperature it would be in the labile state, and with vigorous stirring and seeding, would give a rapid crystallization of fine crystals. If the milk were stirred but slowly at a temperature in the metastable area, large crystals would develop, the rate of growth depending upon the rate at which diffusion of the lactose can take place to the surface of the growing crystal. The above explains theoretically the commercial process wherein lactose is made to crystallize in a finely divided state in condensed milk in order to avoid a later development of large crystals.

We will discuss the application to ice cream later.

Since Hallimond has shown that the limits of the metastable area are affected by the presence of foreign substances, the next question is, What will be the effect of the foreign substances often present in milk and ice cream upon the relative positions of these curves? Lactic acid and sugar appear to force the two curves slightly farther apart. The milk salts in solution have apparently no effect. In the metastable area, however, any of the milk salts which may be precipitated by forewarming of milk apparently induce a slow crystallization which is appreciable at room temperature in about two days.

Since we know that forewarming of a milk may convert some of the milk salts to an insoluble form, it seems entirely probable that, aside from the effect on viscosity, forewarming may produce nuclei for the devlopment of lactose crystals. This possibly would then be a factor in milks stored for long periods or perhaps in the development of sand in ice cream.

Marc (7) has shown that many dyes inhibit crystal growth. The dyes do not inhibit the growth of crystals entirely but bring the crystallization to a standstill before normal equilibrium is reached. It is of course apparent that it would be impracticable to add dyestuffs to milk or ice cream to retard crystallization. It is known, however, that crystal growth may be retarded by materials which, adsorbed to the surfaces of the growing crystal, interfere with normal growth. Since dyes are by their very nature materials which are strongly adsorbed, it seemed worth while to investigate their effects upon lactose separation with the idea that if satisfactory results were obtained, some unobjectionable analogous substance might be used in milk. The effect of dyes on lactose crystallization was studied at room temperature with solutions containing 50 parts lactose to 100 parts water. Of 39 dyes investigated, only three had any apparent effect in retarding crystallization. Rosaniline hydrochloride, crystal violet, and rosaniline base did not exert a practical effect unless present in quantities which colored the solutions deeply. Experiments with the rosaniline showed that the supersolubility curve of lactose could be lowered about 5° by its use.

We may come now to a brief consideration of the sandy ice cream problem. It will not be necessary here to dwell at length upon the facts already known generally, namely, that if the lactose content is not too high, sand will not usually develop, that this defect can be avoided if products free from lactose crystals that may act as nuclei are used, and that trouble can be avoided by holding the ice cream at low temperatures.

But, before proceeding further, let us examine closely the solubility and freezing point curves of lactose-water solutions. We see, first, that if we freeze a lactose solution whose concentration is less than 11.9 parts of lactose to 100 parts of water, ice will separate before the solution becomes saturated with the sugar. This means that the unfrozen portion of the solution with lowering temperature then becomes more saturated with lactose. Theoretically, when the temperature of the cryohydric point is reached, ice and sugar should separate together; but we have shown that lactose is capable of forming highly supersaturated solutions, so in the absence of nuclei we might pass along the freezing point curve, with a further separation of ice and a continued concentration of lactose, into the metastable area. We might even under suitable conditions pass through a super-cryohydric point into the labile area without lactose separation. In this case it is quite probable that the whole mass would solidify, without crystal formation, into an amorphous mass.

Freezing experiments upon lactose-water solutions covering a wide range of concentration show that it is actually possible, if nuclei are absent, to carry these solutions well into the labile state with the separation of ice alone. Lactose solutions of 10 parts of lactose to 100 of water may be frozen solid without the visible appearance of the lactose crystals. It has been found possible to freeze a solution containing 30 parts of lactose without the separation of lactose until a few minutes after freezing starts. In one instance, as judged by the temperature at which crystallization took place, we had a solution containing 70 parts of lactose to 100 of water. In a number of instances, even when the lactose crystals formed, they were so fine that they could be made to pass through a filter paper.

This brief exposition of the significance of the freezing point and solubility curves serves to show us roughly the conditions which exist in ice cream, particularly if the solubility of lactose in the water of an ice-cream mix is not markedly affected by the presence of the other constituents, and as far as we know it is not. A few solubility results are given in the following table:

TABLE 2.—*Solubility of lactose in an ice-cream mix containing 12 per cent fat, 10 per cent milk solids not fat, 14 per cent sugar, and 4 per cent gelatin.*

Temperature.	Parts of lactose to 100 parts of water.
° *C.*	
1	13.54
8	14.91
15	16.05

It is quite evident, then, that, provided there are no lactose crystals present in an ice-cream mix to furnish neuclei for crystal growth, ice cream may be carried well into the labile state. It will also be true that the tendency of the lactose to crystallize after freezing will be small as long as sufficiently low temperatures are maintained. This is in keeping with Hallimond's statement that the tendency to crystallize is lessened when a certain degree of supercooling is exceeded. If crystallization has taken place, the crystals may be so fine as to escape detection, and they will of course not tend to increase in size if low temperatures are maintained. With rising temperatures, as the melting point is approached the tendency to lactose crystallization in either case will increase. We thus see why concentration and temperature—the same factors which largely control the separation of the milk sugar from ordinary solution— are factors in governing the development of sand in ice cream.

So far we have called attention to the effect of temperature, concentration, and seeding on lactose crystallization from aqueous solution, endeavoring to show the bearing of this on the separation of milk sugar from concentrated milk and ice cream.

When we are dealing with milk solutions, however, the conditions are not so simple as with pure aqueous solutions. The viscosity becomes a factor in controlling the rate of diffusion of the lactose to the growing crystal. The preliminary treatment of the milk may have been such as not only to affect viscosity, but to produce nuclei favoring crystallization. For example, we have already shown that the forewarming of a milk can produce nuclei in the form of insoluble salts which may induce lactose crystallization in both metastable and labile areas, and it is well known that forewarming markedly affects the viscosity of both evaporated and condensed milks.

Lactose does not usually give trouble in ice cream unless the concentration is high (that corresponding to a milk solids not fat concentration of about 12 per cent). It will probably never be possible to use high lactose concentrations in ice cream without producing sand. The work on ice cream now in progress at the Dairy Division laboratories has for its aim the determination of the conditions which will permit the presence of this maximum concentration of lactose without crystallization. In other words, we have determined the major factors governing the separation of lactose from aqueous solution; we are now engaged in determining the minor factors controlling the separation of milk sugar from the ice cream.

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Chairman Martin. I am sure many of you have had actual experience with sandy ice cream and I know you have been interested in Mr. Leighton's discussion as to how it may be avoided.

This concludes the list of papers whose authors are present. Unless specially requested the remaining papers will be read by title.

Does anyone desire any discussion from the speakers who have read their papers this morning?

Mr. Charles H. Snow (representing the Illinois Association of Ice Cream Manufacturers). I would like to ask Mr. White if he has had any experience regarding the effect of homogenizing at different temperatures in the pan on the casein and albumin content, and I would like to hear what it is.

Mr. White. Just in what way do you mean?

Mr. Snow. As it affects the albumin.

Mr. White. I am afraid I can't give you any information on that point at all. I have had no experience along that line.

Mr. Snow. We are preparing cream in that manner, and our experiments show there is considerable variation in final results obtained.

Professor Mortensen. We have carried on some experiments along that line. We have found that the greatest factor there is the agitation of the milk. You will never have the same viscosity. And that is what I mentioned to have been the greatest factor—the clumping together of the different globules. You can take a combination of casein and you can homogenize it and you will not have any increase in the viscosity.

There is another factor of breaking up the fat clumps. We have physical chemists, and I always let them talk on that subject, because I am not prepared. But it is evident that there is more fixed serum on account of the fat globules because there is more surface exposed. But the big factor is the clumping together of fat globules. By stirring that mix (and you homogenize the mix first) you will have a great deal of viscosity. If you are stirring that mix you are breaking up the fat clumps and you are reducing the viscosity in proportion to the way you are breaking up those fat clumps.

Mr. SNOW. In our particular method of handling we do not agitate after homogenizing the mix any more than the agitation caused by the flowing over the cooler. Whatever agitation there is is all done before homogenizing. And yet our experiments with condensed milk, even skimmed condensed milk, show that under some conditions of temperature and pressure, different conditions arise as to the viscosity which are not controlled by the acidity or other conditions.

Another thing. I guess it is the experience of everyone who has handled condensed milk, that homogenizing will destroy the viscosity of superheated condensed milk. You can obtain it in the pan by superheating and passing it through the homogenizer and thus reduce that viscosity. That seems to mean that those larger casein particles that have been thrown out by the superheating process are either redissolved or so finely divided as to reduce their viscosity and thickening quality in the condensed milk.

It seemed to me that in the homogenizing of both the fat and the milk in the same mixture at the same time we were carrying on two contradictory processes. In other words, the homogenization of the fat increases the viscosity, but I have also been led to believe that the homogenizing of the milk solids not fat at the same time under conditions which would give maximum viscosity from fat alone might reduce the viscosity obtainable from the milk solids not fat.

There seem to be two different types of ingredients in the mixture; and in our process when both are carried on at the same time, we find they are contradictory in their results. I wonder if any one has done any experimental work along that line.

Chairman MARTIN. Mr. Mortensen is a practical ice-cream man. I know it. I have seen him make ice cream.

Professor MORTENSEN. I am not able to answer those questions, because I haven't had the experience with the condensed milk as you have had. We have a man on those problems now, but it takes a long time to get results. The people in Washington are pretty well along in that line of work.

Mr. SNOW. I would like to say that I am an infant in this preparation of ice-cream mix in the vacuum pan and putting the whole mix through the vacuum pan. We have been doing it only this past season. We installed the vacuum pan in May, and that is all the experience I have had in it. But in the time we have had it we have had several things arise that we have had to solve, and this is one of them: We attempted to make a mix which would give satisfactory results without the use of any quality of that kind, and we found that homogenizing seemed to undo the benefits which are ordinarily obtained by the use of superheated condensed milk. When we discovered that we then made some experiments on superheated condensed milk to see what the effect of the homogenizing process was on it. I was surprised to find that under certain conditions of temperature and pressure you can very nearly destroy entirely the benefit of superheating by the use of a homogenizer on that product.

It has been the practice of many ice-cream manufacturers, and it was previously our practice, to place in a large vat the condensed milk which had previously been superheated, to add the other ingredients to it, and to homogenize the entire product. It seems we were wrong in adding that condensed milk in the vat and having it homogenized. Of course, the acidity of the mix controls to a great extent the effect of the homogenized product too, and it is probable we have, through the use of superheated condensed milk, cream, and whole milk in our Pasteurizers, homogenizing the entire quantity, been obtaining the benefits of a high acid content on the final viscosity; while, when we shift it to this other process, using milk as it comes from the producers, the acid content runs lower than in the same products after passing through another condensery, and more goes into the products, with the result that, from an acidity standpoint, our mix is coming through much lower in acidity than it was when we were using the former method. And I ascribe to that factor the decreased viscosity which we got when we changed to this pan method, rather than to the fact that we are not superheating the mix we put in the pan. Our own experiments show that the homogenizing of condensed milk puts it in the condition in which it would be if it had not been superheated. We stumbled onto that discovery entirely because we thought if a homogenizer might be good in one place it might be good in another.

Professor MORTENSEN. At what temperature do you homogenize?

Mr. SNOW. In this case we dropped it from 105° to 100°—at that temperature.

Professor MORTENSEN. Would that have any effect on the lactose?

Mr. SNOW. The pressure approximately is 2,500 pounds per square inch. The viscosity is less at a Pasteurizing temperature. The final result is a lower viscosity. The maximum viscosity seems to occur at either a low temperature or a high temperature. You can use temperatures from 90° to 105° if you want a higher viscosity.

The acidity content of the mixes has a great deal to do with the final viscosity in the homogenizing process. We also have homogenized a great deal of sweet cream, some of it from butter and whole milk; and we find that the acidity content of the sweet butter varies a great deal, and that variation will cause a variation in the final viscosity under identical conditions. So that seems to have quite an effect.

Mr. ZOLLER. I would like to ask the gentleman whether he uses gelatin in his mix or not.

Mr. SNOW. Yes, indeed.

Mr. ZOLLER. Gelatin plays an important part in the physical conditions under which the mix is handled prior to the time it is allowed to set in the vat. I have a little different conception of what we term viscosity, and I don't intend to burden you with that now.

But I would like to say we have been working on that problem for some time, and it seems to me that in the case of the superheated milk in the superheated process you have a relation, and by passage of that product through the homogenizer you will generally disperse that coagulated mass into gelatin; that gelatin tends to prevent the recombination of those particles, and the tendency is an apparent lower viscosity.

But I take it that we are interested in the viscosity from two standpoints. One is its effect on the acid content and the other is the effect on the overrun capacity of the mix, and our experience has been that the homogenizer will perform upon the mix the same function that superheating will perform upon the mix, providing the two mixes are constant and held under the same conditions. I figure from that basis that the heat effect in the coagulation of the other materials is simply due to the high pressure effect on the coagulation of the proteids in the other materials. And while you will not get exactly the same degree of viscosity, you will get the same kind of viscosity in both cases.

Mr. Snow. I might say that in addition to the gelatin we make mixes both ways. Some of our mixes contain no gelatins. But there is an apparent difference in the viscosity of the mix prepared without being superheated and passed through the homogenizer, and another mix, prepared by the mixture of the cream and superheated, prepared without gelatin, and to which sugar might be added.

Mr. Zoller. Your experience is, then, that the two mixes are different as regards their power to yield?

Mr. Snow. Yes; in making the viscosity. As to the power to yield, I might say that apparently the mix prepared without superheating will yield more than the one prepared by heating, but it does not have the power to retain its incorporated air so well. It will tend to make it more foamy than ice cream which will liberate the air from it. But it does not have a good texture and firmness in the product. The ability, though, to secure overrun is apparently not one of our troubles at all. But the viscosity of the final product that overruns rapidly, leaves the can and causes very rapid melting, that is a difficult condition.

Chairman Martin. Is there any further discussion on any of the papers or the part that has been discussed? It is regrettable we can't bring more discussion out of this meeting.

(Adjournment.)

(Papers read by title):

STANDARDIZING THE ICE-CREAM MIX.

Willes Barnes Combs, associate professor of dairy manufactures, Pennsylvania State College, State College, Pa.

The term "standardize" as used in connection with dairy products may be construed to have several meanings. Webster's New International Dictionary of the English Language defines the term "standardize" as follows: "To reduce to or compare with a standard: to render standard; to determine the strength, scale, value, etc., of, by comparison with some standard; as, to standardize a solution: to standardize a voltmeter." Dairy specialists for a number of years have used the term as referring to an alteration or modification of the chemical composition of milk or cream. Mojonnier and Troy (1), in their late book entitled "The Technical Control of Dairy Products," state that standardization is usually understood to mean either the raising or the lowering of either or both the fat or solids-not-fat content of all dairy products to a certain fixed standard. If the phrase "as set by law" were added to this definition the term would no doubt be strictly correct; but since the "fixed standard" varies with practically every individual plant, the term "modify" would seem more appropriate. "Standardizing" in this paper will refer to the preparation of an ice-cream mix of a definite and fixed composition and to fixed methods of handling the ice-cream mix until it is ready for the freezer.

As the ice-cream industry progressed in the United States a need was felt for laws which would govern the amount of butterfat that the mix should contain. In 1906 the United States Department of Agriculture (2) defined ice cream as follows: "Ice cream is a frozen product made from cream and sugar, with or without a natural flavoring, and containing not less than 14 per cent of milk fat. Fruit and nut ice cream must contain not less than 12 per cent of milk fat." While no laws were ever passed by the Federal Government which would make the above composition legal, many of the States passed laws adopting these standards. Other States adopted standards of their own.

The early manufacturers paid little attention to the chemical composition of their ice-cream mix. They followed a set formula by which they prepared their mix, which consisted of a definite number of gallons of cream, milk, or skim milk, a definite number of pounds of sugar, and if gelatin or vegetable gum was used it was perhaps weighed. Seldom did the manufacturers give any attention to the pounds of butterfat which went into the mix, the result being a very ununiform product. With enforced fat standards the ice-cream manufacturer was compelled to give attention to this point. The wide-awake manufacturer was prompt to see the advantage of making an ice-cream mix of definite per cent of butterfat. It made it possible for him to buy milk and cream on a butterfat basis, which enabled him to keep more accurate cost accounts. Ice cream became more uniform, and the public, learning this fact, slowly developed a better liking for the product. As business grew, competition became keener and more rigid cost accounts developed. The butterfat content was often cut, as this item was the most costly of the basic products making up the mix. Ice-cream manufacturers organized and were quick to complain against the high fat standards which had been adopted by many of the States. In a few States they were able to hold the butterfat standard to a lower limit.

As time went on the idea developed that a high-grade product might be made by substituting milk solids not fat for the butterfat in ice cream. This idea spread, developing the opinion that the ice-cream manufacturer should not only give thought to the butterfat contained in his ice cream but he should give attention to the milk solids not fat, the total solids, the sugar, filler, flavors, and binder content. The result in the United States has been a varied composition ice-cream mix which has brought to our attention two questions which shall be reviewed in this paper, namely:

1. What should be the composition of the ice-cream mix?
2. Should the methods of manufacturing ice cream be standardized?

WHAT SHOULD BE THE COMPOSITION OF ICE CREAM?

At present the composition of ice cream in any locality depends largely on several important factors, namely, (1) the per cent of fat required by the State law; (2) the quality of ice cream demanded by the public; (3) ease by which the milk products are obtained.

The manufacturer is compelled to give attention to the composition of the ice-cream mix in those States having laws governing the per cent of one or more ingredients. The following table lists the States and Territorial possessions of the United States, giving their legal butterfat and gelatin standards for ice cream:

TABLE 1.—*Legal standards of butterfat and gelatin in ice cream.*

State.	Plain ice cream.		Fruit and nut ice cream.	
	Fat.	Gelatin.	Fat.	Gelatin.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Alabama				
Alaska*				
Arizona				
Arkansas	(1)	(1)	(1)	(1)
California	10	0.6	8.0	0.6
Colorado	14		12.0	
Connecticut*				
Delaware*				
District of Columbia*				
Florida	14		12.0	
Georgia	8		8.0	
Hawaii*				
Idaho	14	(2)	12.0	(2)
Illinois	8		8.0	
Indiana	8	.7	8.0	.7
Iowa	12	1.0	10.0	1.0
Kansas	10		10.0	
Kentucky	10		8.0	
Louisiana	10	1.0	8.0	1.0
Maine	14		12.0	
Maryland	8	1.0	6.0	1.0
Massachusetts	7		7.0	
Michigan	10	.7	8.0	.7
Minnesota	12		10.0	
Mississippi	8	.5	8.0	.5
Missouri	8		8.0	
Montana	10	1.0	9.0	1.0
Nebraska	14		12.0	
New Hampshire	14	.2	14.0	.2
New Jersey	8		6.0	
New Mexico				
Nevada	14		12.0	
New York	8		6.5	
North Carolina	8	.2	8.0	.2
North Dakota	12	(3, 4)	10.0	(3, 4)
Ohio	8	.5	8.0	.5
Oklahoma	10		8.0	
Oregon*	12	1.0	9.0	1.0
Pennsylvania	8	.5	6.0	.5
Philippine Islands	14		12.0	
Porto Rico*				
Rhode Island	8	1.0	8.0	1.0
South Carolina				
South Dakota	14		12.0	
Tennessee	8		6.0	
Texas	8		6.0	
Utah	(1)	(1)	(1)	(1)
Vermont	14		12.0	
Virginia	8		8.0	
Washington	8		8.0	
West Virginia				
Wisconsin	12	.5	10.0	.5
Wyoming	10		10.0	
United States	14		12.0	

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[1] Federal standard.

[2] Not allowed.

[3] Must be labeled "Gelatin ice cream."

[4] 2 ounces in 10 gallons.

NOTE.—The above standards are correct on date of October 1, 1923, according to the offices in the various States having the enforcement of the laws in charge. In those States or possessions where no reply was received the name of the State or possession is followed by an asterisk (*). The remainder of the report was made up from Melvin, A. D., Legal Standard for Dairy Products, United States Department of Agriculture, 1916. If a space is left blank, no standard exists. North Carolina permits what it terms "compound ice cream" which may contain 4 per cent butterfat and must be labeled "compound ice cream."

The above standards represent the combined opinion of many individuals, a large number of whom were, no doubt, trained dairy specialists. We should, therefore, be in a position to select at least a butterfat standard for ice cream by making a study of these requirements. However, this does not seem to be possible after it is observed how the State standards vary, ranging from 7 to 14 per cent.

From the above table, 41 of the States in the Union have butterfat standards for ice cream, with an average of 10.22 per cent required. That a high per cent of fat is still favored is pointed out by the fact that 26.83 per cent of the States have a 14 per cent butterfat standard on plain ice cream and 58.52 require 10 per cent or above. The National Ice Cream Makers Association's recommendation of an 8 per cent standard has been adopted by 39 per cent of the States having fat standards. It must be realized also that in the revision of State standards in no case has the fat standard been raised above the 14 per cent standard, but in one case, Missouri, the standard was lowered from 14 and 12 per cent to 8 per cent.

Ice cream is defined by the National Association of Ice Cream Manufacturers (2) as follows:

> First. Ice cream is a frozen compound, varied as to kind and proportion of ingredients within the limits established by custom and usage.
>
> Second. Ice cream consists chiefly of a sweetened and flavored mixture of cream, or cream and milk, or milk, with or without added milk fat in the form of evaporated or concentrated milk or in milk powder, and with or without added milk solids not fat in the form of skim-milk powder or as contained in milk powder or in condensed, evaporated, or concentrated skim milk, or of a sweetened and flavored homogenized or emulsified mixture of sound, sweet butter, milk powder, or skim-milk powder, and water, with the addition of gelatin, vegetable gum, or other wholesome stabilizer.
>
> Third. Standard ice cream contains not less than 8 per cent milk fat and the content of milk fat and milk solids not fat combined shall not be less than 18 per cent, except when the ingredients of standard ice cream include eggs, fruit, or fruit juice, cocoa or chocolate, cake, confections, or nuts such reduction of the percentage of milk fat and milk solids not fat as may be due to the addition of such ingredients shall be allowed.

The law in New Jersey which became effective in October, 1922, defines ice cream as follows:

> Ice cream is hereby defined as the frozen product made from cream with the addition of milk, or milk products, or eggs, fruit juices, or nuts, with or without sugar or artificial flavoring or colors. It shall contain not less than 8 per cent of milk fats, except when the ingredients include fruit, nuts, or eggs, in which case it shall contain not less than 6 per cent of milk fats.

The above definition is probably typical of the definitions which have been written into the State laws during the past few years.

Earlier definitions were more like the definitions given by the United States Department of Agriculture. In many States the milk solids not fat in ice cream have come into consideration. In the States of Washington, New York, Indiana, and Tennessee ice cream must contain 18 per cent of milk fats and milk solids not fat and in the State of Kansas 20 per cent total milk solids are required. The State of Montana has a law requiring 33 per cent of total solids in ice cream and Oklahoma requires 32.5 per cent of total solids.

In discussing fat standards for ice cream in 1917, R. M. Washburn (3) states that a standard composition for ice cream should be based upon the needs of ice cream as a food. He states that a standard of 9 or 10 per cent is sufficient for all useful purposes and that a high fat is only a national waste. In a later article Washburn (4) concludes that the fat percentage in plain ice cream should be 10 per cent, and in fruit and nut ice creams 8 per cent. In this article he compares ice cream to milk, stating that the nutritive ratio of average milk is 1:3.7 and that ice cream should come nearer to this proportion if it is to serve as a food for all purposes. The compositions cited by Washburn show ice cream containing 14 per cent of fat to have a nutritive ratio of 1:17.1, while ice cream containing 9.4 per cent fat has a nutritive ratio of 1:6. In 1923 Washburn (5) points out that a 3.25 per cent milk contains 2.65 per cent pounds serum solids for every pound of fat and that 27.38 per cent of the total solids is fat. He shows that a 10 per cent fat and 36 per cent total solids ice cream has 2.60 to 1 in ratio of serum solids to fat, and 27.77 per cent fat in total solids.

When addressing the Illinois Ice Cream Manufacturers' Association Mr. H. A. Ruehe (6) states that we have various opinions as to what the fat content of ice cream should be. A few consumers would have ice cream contain 14 to 18 per cent butterfat; on the other hand, there are some manufacturers who feel that 8 per cent is sufficient. There is no doubt but that there should be sufficient butterfat present in ice cream to give it richness of flavor, which is most desirable. On the other hand, there is no need for an excessively high fat content. He concludes that the ice-cream mix should contain 10 to 12 per cent of butterfat, to give the richness desired by most consumers, and a total solid content of 34 to 36 per cent, depending on the processes to which the mix is subjected.

With a view of settling the question regarding the consumption of ice cream containing a high and a low fat content, A. D. Burke (7) prepared two tables of statistics. In his first table he shows the gallons of ice cream consumed in each State, the population, and the pounds of ice cream consumed per capita when the percentage of fat in both plain and fruit ice cream is relatively high. In his other table the same items are shown when the percentage of fat in both plain and fruit ice cream is relatively low. He points out that the States that have the largest population required the lowest fat standard in ice cream, and that there was the greatest average consumption of ice cream per capita in the States which required the low standards. In the States where a high standard is demanded, consumption runs very close to 5 pounds per capita per State per year; whereas, in those States where the fat standard is low the pounds of ice cream consumed per capita per year amount to approximately 7 pounds, or about 2 pounds more than in those States having a low standard. He does not discuss the figures or attempt to prove their worth.

To show the public's preference for ice creams of various richness in butterfat, sweetness, and firmness, O. E. Williams and G. R. Campbell (8), of the United States Department of Agriculture, made ice creams of different compositions and sold them on a market where about 50 daily purchasers had an opportunity to choose from three different kinds without knowing anything about the ingredients contained. Eighty-two per cent of the purchasers favored ice cream that contained 18 per cent of fat; 10.4 per cent chose that containing 15 per cent, and 7.6 per cent selected the ice cream containing 12 per cent. More than 60 per cent chose ice cream containing 19 per cent sugar; nearly 30 per cent preferred a sugar content of 16 per cent, and 10 per cent selected the product with 13 per cent sugar. The preference for different proportions of solids not fat was tested in ice cream made to contain 10 per cent of fat. More than 50 per cent of the 1,185 total sales were in favor of the ice cream containing 12 per cent milk solids not fat and more than 80 per cent of the sales were in favor of ice cream containing at least 9 per cent milk solids not fat. The largest majority, 63 per cent, preferred 1 per cent of gelatin, nearly 14 per cent preferred 0.5 per cent gelatin, and 23 per cent preferred no gelatin in ice cream.

A. S. Ambrose (9), after conducting an experiment upon the effect of composition of the mix upon the quality of ice cream in which he compared ice cream ranging in fat from 8 to 14 per cent and in milk solids not fat from 6 to 18 per cent, came to the following conclusions:

> In general a good commercial ice cream can be made with from 10 to 12 per cent of milk solids not fat and 8 to 14 per cent butterfat. An excellent quality ice cream was obtained with a 12 per cent butterfat and 12 per cent milk solids not fat.

In order to secure first-hand information regarding the composition of ice cream, ingredients used, and methods practiced in our principal ice-cream factories, the writer sent the following question sheet to about 100 prominent factories in different localities in the United States:

QUESTIONS.

1. Gallons ice cream made in 1922.
2. Do you use an ice-cream mix of a definite composition?
3. Do you use any condensed milk in your mix? (State the kind.)
4. Why do you use the condensed milk? (Please state fully.)
5. Do you use powdered milk of any kind in your mix?
6. State why you use powdered milk in your mix? (Please state fully.)
7. Do you use any kind of stabilizer, such as gelatin, gum, tragacanth, Irish or Iceland moss? (Name stabilizer.)
8. Do you use any kind of filler such as cornstarch, rice flour, arrow-root, wheat flour, and eggs? (Name filler.)

9. Give the composition of your ice-cream mix:
   Per cent butterfat____
   Per cent milk solids not fat___________________________________
   Per cent sugar____
   Per cent gelatin____
   Per cent gum tragacanth______________________________________
   Per cent filler____
   Per cent other ingredients____________________________________

   Total____
10. Do you Pasteurize the entire mix? If you do not Pasteurize the entire mix, what portion, if any, do you Pasteurize, and why do you follow the procedure you do?
11. Do you viscolize, homogenize or emulsify the entire mix? (State what method is used.)
12. If you do not viscolize, homogenize, or emulsify the entire mix, do you use any of these processes for any portion of the mix? Why?
13. At what temperature do you Pasteurize?
14. At what temperature do you viscolize; homogenize; emulsify?
15. Why do you use the temperature you use in viscolizing, homogenizing, or emulsifying?
16. What pressure do you use on your viscolizer or homogenizer?
17. Do you age your entire mix?
18. Explain why you age the entire mix.
19. If you do not age the entire mix, what portion do you age, and why?
20. Do you give any attention to the acidity of the mix before Pasteurizing; homogenizing; viscolizing; emulsifying; aging; freezing? Explain why and give the percentages preferred.
21. Do you consider the viscosity of the mix important? Why?
22. Do you use any kind of ice-cream powder in your mix? Why?

About 30 per cent of the factories to which this questionnaire was sent submitted answers. Since we are now discussing the composition of the mix, we shall take up that portion of the questionnaire at this point, leaving the remainder to be discussed under methods of preparing and handling the mix. The reports upon the composition of the ice-cream mixes are tabulated in Table 2.

TABLE 2.—*Composition of ice-cream mix as reported by 31 prominent ice-cream factories in the United States.*

Factory No. and State.	Quantity made in 1922.	Fat.	Milk solids not fat.	Sugar.	Gelatin.	Filler.	Other solids.	Total solids.	Remarks.
	Gallons.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	
1. Maine	699,787	14.2	7.8	14	0.5	0.0033	None.	36.8	Improver used.
2. Illinois	510,000	13	9	14	.5	None.	None.	36.05	
3. New York	500,000	11	10	14	.5	None.	1	36.5	Powdered eggs used.
4. California	1,185,000	10.5	11	14	.5	None.	None.	36	
5. Massachusetts	1,250,000	10	10	17	.35	.15	None.	37.5	Do.
6. Vermont	700,000	14	10	16	.25	None.	None.	40.25	
7. Ohio	(1)	11	12	13.5	.5	None.	None.	37	Powdered eggs, 0.5 per cent.
8. Pennsylvania	550,000	12	8	15	.5	.5	.5	36.5	
9. Michigan	200,000	10	12.5	14	.5	None.	None.	37	
10. Colorado	343,000	14	6.67	13	.33	None.	None.	34	Eggs used.
11. Texas	280,878	10	12.25	11.75	.5	None.	None.	34.5	Eggs used in special ice creams.
12. California	1,000,000	10.5	11	14	.5	None.	None.	36	
13. Minnesota	600,000	12.5	10.5	14	.4	None.	1	37.5	
14. Arizona	126,000	11	11	13	.5	None.	None.	35.5	
15. Kansas	338,814	11	11.1	13.8	.5	None.	None.	36.4	
16. Massachusetts	389,165	14	6.8	[2] 15.2	.5	.5	None.	37	Cornstarch used.
17. Pennsylvania	400,000	11.5	11.6	14.4	.5	None.	None.	38	
18. Tennessee	300,000	12	9.5	14	.5	None.	None.	36	Improver used.
19. Pennsylvania	1,482,343	10.75	11.88	15	.37	None.	None.	38	
20. Kentucky	275,000	10	10	14	.5	None.	None.	34.5	
21. Indiana	364,719	8.5	12	13.5	.5	None.	None.	34.5	
22. Colorado	200,000	13.5	9.5	12.5	.5	None.	None.	36	
23. Indiana	516,000	9.5	....	....	....	None.	None.	36	
24. Iowa	225,000	12	10	1.3	.55	None.	None.	35.5	
25. Indiana	....	8.5	11.5	12.5	.5	None.	None.	33	
26. Illinois	1,800,000	14	12.95	12	.45	None.	None.	37	
27. Pennsylvania	350,000	12	12	14	.5	None.	None.	38.5	
28. Massachusetts	900,000	12	13	14	.005	.005	None.	39.01	Egg powder used.
29. Pennsylvania	....	12	11.6	14	.4	None.	None.	38	
30. Iowa	300,000	12	10	13.5	.5	None.	None.	36	
31. Rhode Island	....	10.25	10.5	14	.5	.9	None.	35.9	Do.
Average	....	11.52	10.52	13.95	.453	....	....	36.46	

[1] No report.

[2] No. 16 uses corn sugar as sweetener.

Though the survey is small in character, it represents a good proportion of the leading manufacturers scattered throughout the United States. The report indicates that these factories manufacture ice cream of the following average composition: Butterfat, 11.52 per cent; milk solids not fat, 10.52 per cent; sugar, 13.95 per cent; gelatin, 0.453 per cent; and total solids, 36.46 per cent.

The question naturally arises as to why so few factories are making an ice cream testing 14 per cent. In order to get at this point, the fat contents of the ice-cream mixes reported by factories are tabulated below, comparing this composition with the standard in the State in which each factory is located.

TABLE 3.—*Butterfat content of ice cream made in factories reporting, as compared with the legal standards in the States where these factories are located.*

State.	Butterfat content reported by factory.	Butterfat standard of the State for plain ice cream.	Difference.
	Per cent.	*Per cent.*	*Per cent.*
Maine	14.2	14	0.2
Illinois	13	8	5
Do	14	8	6
New York	11	8	3
California	10.5	10	.5
Do	10.5	10	.5
Massachusetts	10	7	3
Do	14	7	7
Do	12	7	5
Vermont	14	14	....
Ohio	11	8	3
Pennsylvania	12	8	4
Do	11.5	8	3.5
Do	10.75	8	3.75
Do	12	8	4
Do	12	8	4
Michigan	10	10	....
Colorado	14	14	....
Do	13.5	14	—.5
Minnesota	12.5	12	.5
Arizona	11	....	....
Kansas	11	10	1
Tennessee	12	8	—4
Kentucky	10	14	4
Indiana	8.5	8	.5
Do	9.5	8	1.5
Do	8.5	8	.5
Iowa	12	12	....
Do	12	12	....
Rhode Island	10.25	8	2.25
Texas	10	8	2

Here it is noted that a 14 per cent ice cream occurred in five factories, and three of these are located in the States of Maine, Vermont, and Colorado, where a 14 per cent standard is in force. The factories in Illinois are manufacturing ice cream containing 5 to 6 per cent more fat than the State standard requires, and the one in Massachusetts 7 per cent higher. These factories no doubt believe that butterfat adds to the quality of their ice cream. In no case where an 8 per cent standard is in force do we find the manufacturers making ice cream of this low standard. The factories in Indiana come as close to the standard in two cases as they can for safety's sake, while the factories in Illinois, Ohio, Pennsylvania, Tennessee, Rhode Island, and Texas range from 2 to 6 per cent above the 8 per cent standard. Though the ice-cream manufacturer favors an 8 per cent standard, he is inclined to make a better quality ice cream than can be made with this fat content in his own factory.

What, then, is to be the composition of the ice-cream mix? After analyzing the foregoing, it is almost impossible to draw a conclusion. Our State standards differ, our authorities do not entirely agree, and the experimental data on the subject are inadequate. However, in the writer's mind the work conducted by Williams and Campbell and that conducted by Ambrose is in the right direction. The public is to be the judge. Too often we hear people say ice cream is "frozen milk." The public must learn to know ice cream as a delicious, rich, velvety pleasing food which can not be resisted. This will never be accomplished by a low butterfat and total solids ice cream. An ice cream containing 14 per cent of butterfat, 9 per cent milk solids not fat, 15 per cent sucrose, and 0.5 per cent of gelatin, if desired, should meet this purpose. The writer agrees that a good ice cream can be made using a fat content of 12 per cent, but butterfat gives a characteristic rich creamy flavor to ice cream that labels ice cream as a *dairy product*, and rather than reduce the quality a manufacturer would better raise it, even if a 16 per cent fat is reached.

STANDARDIZING THE METHODS OF HANDLING THE ICE-CREAM MIX.

Some interesting points were noted upon examining the reports, mentioned heretofore, submitted by the ice-cream factories over the country. In every case the manufacturer reports that he gives attention to the chemical composition of the ice-cream mix. This indicates that the mix is calculated, and a definite amount of each ingredient added according to its chemical composition. Not only do these factories calculate the per cent of butterfat, but the milk solids not fat are calculated to a definite amount. In 45 per cent of these factories plain concentrated skim milk is used in building up the milk solids not fat in their ice-cream mix; five plants use powdered whole milk, three powdered skim milk, one sweetened condensed whole milk, one sweetened condensed skim milk, four concentrated or evaporated whole milk, and two superheated condensed skim milk. In every case the reason given for using these products in ice cream was that they are necessary to raise the solids not fat. A few factories, however, add that the condensed milk improves the body and texture of their finished product. One factory states that the use of concentrated or evaporated whole milk tends to cut down the size of ice particles. Another factory using superheated condensed skim milk states that this practice results in a smoother-body ice cream.

Those factories using powdered milk maintain that this product keeps better in storage, requires little refrigeration, is more uniform in quality, and can be bought in the spring and held through the summer, making it a cheaper product. One manufacturer states that by combining powdered milk and sweetened condensed whole milk grainy ice cream was eliminated. All but one of the manufacturers reporting use gelatin in their mix, two make use of ice-cream improvers, and seven plants are using eggs or powdered egg yolks. Of the plants reporting, two condensed their entire ice-cream mix.

The Pasteurizing temperatures reported range from 120° to 170° F. All of the plants either viscolize or homogenize their entire mix, with the exception of those plants using improvers. These plants viscolize or homogenize the entire mix, with the exception of the ice-cream improver. One plant reported that they added gelatin and sugar to the mix after Pasteurizing and aging, or just before freezing the mix. The pressures used in homogenizing the mix range from 1,500 to 3,000 pounds at temperatures varying from 100° to 160° F. The pressures used in viscolizing range from 1,500 to 4,000 pounds at temperatures from 110° to 160° F. All but one of the plants reporting age their mix after homogenizing or viscolizing. Only a few of the plants stated the time given to aging the mix, but of those reporting the aging period ranged from 24 to 48 hours. Most of the plants gave no attention to acidity, only requiring that the mix be sweet. More of them reported on the acidity preferred at the time of freezing; this factor varying from 0.15 to 0.5 per cent. One plant stated that the acidity was standardized to 0.15 per cent.

All but three of the plants reported that they considered viscolizing important in the manufacture of a smooth ice cream. Many stated that viscolizing was essential in obtaining overrun. However, one plant states that though they used to be of this opinion their experience has taught them that viscolizing bears no relation to overrun. This concern ages the mix for 24 hours after homogenizing at 1,500 to 2,000 pounds pressure at 150° F. The object of aging, it is explained, is to soften the casein and to break down the milk solids not fat. Several operators state that the viscosity has considerable influence on the time of freezing.

It seemed to be the general opinion that the color of ice cream is important. One operator states that people eat 50 per cent with their eyes, while another states that a large per cent of the consumers have poor taste but good eyesight. A few plants report, however, that color in their locality is of no importance.

After reviewing the reports on the methods of preparing and handling the mix, it is again impossible to make any definite recommendation. It would seem, however, that, though much discussion has been given in the past to the composition of the ice-cream mix. too little attention has been given to the methods of handling the mix. To-day it is necessary for each individual manufacturer to work out his own problems, which after being solved to one operator's satisfaction and passed on to the next do not give satisfaction. To a large extent the whole question boils itself down to the quality of dairy products obtainable. These vary; therefore methods of manufacture vary and the quality of ice cream varies.

DISCUSSION.

After considering the question of standardizing the ice cream, the magnitude of the problem becomes evident, yet at this writing too little evidence is available from which definite conclusions can be drawn. There is one fact, however, that must not be overlooked: ice cream is a milk product and must remain as such. In every State in the Union having an ice-cream standard, butterfat is specified as the fat that must be present in ice cream. Foreign fats have been ruled out in many cases where a tendency to use them became evident. Foreign fats will never be used in ice cream in the United States as long as we give the public a reasonable proportion of butterfat in ice cream. If the butterfat content is cut to a point where it is difficult to detect, butterfat substitutes might easily be used without public detection. We should not educate the public against the use of butterfat in ice cream; rather should we keep before it constantly the fact that it is used. Ice cream does not have the creamy, delicious flavor when made containing 8 to 10 per cent butterfat that it has when made containing 14 to 16 per cent of butterfat. No one has denied this fact in all the opinions that have been advanced on this subject. It has been stated that the sick, invalids, and the old will relish ice cream of a lower fat standard. This fact must be granted, but all do not come under this classification. The general public must be the judge, and ice cream made of a composition and at such a cost that it can be sold to meet with the approval of the greatest number of people in a given locality. This, in the writer's mind, is just what is slowly taking place with most of the manufacturers over the United States.

Burke's (7) tables, which indicate that the higher consumption of ice cream per capita takes place in those States having a low fat standard, do not tell the story of the public's preference. It is doubtful if the ice cream in any State in the Union, where an 8 per cent standard is in force, will average so low. Many ice-cream manufacturers tell us that it is the laboring class of people that eat the bulk of ice cream made in the United States. This factor certainly would have to be considered in looking at the consumption in States such as Pennsylvania, Ohio, and Indiana, where the laboring class predominates. A study of economic conditions indicates that with strikes, lack of demand for labor, etc., ice-cream consumption drops. If it were possible to make a survey of the quality of ice cream made in the United States, the writer ventures to state that this factor would be found to be one of the most important factors affecting the consumption of ice cream per capita in the States. Pennsylvania is known to make a high-quality ice cream, particularily in its larger cities. The State's standard for plain ice cream is 8 per cent, yet the average in the State is nearer to 11.5 per cent fat and 36 per cent total solids. It is not unusual in Pennsylvania to find ice cream testing 38 per cent total solids. Perhaps it is this factor that makes Pennsylvania the leading State in the Union both as to the production of ice cream and the consumption per capita.

The American public delights in seeing the game of competition. The American business man seems to thrive upon it. Low State standards have given us keen competition, and after the mist has cleared we will learn that after all the public was the judge, and on the pedestal of success will stand its favorite. High quality will rule.

Though much discussion has been given to the composition of the ice-cream mix, too little attention has been given in the past to the quality of dairy products used in ice cream as well as the methods of preparing and handling the mix. Uniform methods will never be found in the United States until more uniform raw products are produced. A few States require Pasteurization of the ice-cream mix, while in one or two instances where Pasteurization was a law the law was repealed. Only a few States give any attention to viscolization or homogenization, permitting these procedures. The bacterial content of ice cream has been largely enforced by our larger cities; no States have taken up the enforcement of this factor. More attention should be given to methods and sanitary conditions in the future. It is doubtful whether we should invite action through our State governments on these matters. However, Pasteurization should be enforced in every State in the Union, as it adds materially to the safety of the product as a food. The demand for high quality will bring about other changes in the industry as the public is willing to pay for them.

CONCLUSIONS.

1. The composition of the ice-cream mix should be that which meets with the public demand.
2. The public should not be allowed to lose sight of the fact that ice cream is a dairy product.
3. As a rule, the public prefers a rich, mellow ice cream, such as can made from a mix containing 14 per cent butterfat, 9 per cent milk solids not fat, 15 per cent sucrose, and 5 per cent gelatin. A 12 per cent fat standard seems very much in favor in the United States.
4. The entire mix should be Pasteurized at a temperature of at least 145° F. for 30 minutes.
5. Experimental work is badly needed on methods of care and handling the mix in the ice-cream factory.
6. The quality of ice cream must be at least maintained if consumption of ice cream is increased in the future as it has in the past.

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SANDY ICE CREAM.

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Sandiness in ice cream has caused more worry to the ice-cream manufacturer than any other technical problem. This defect of ice cream is characterized by the appearance of gritty, sand-like substances occurring in the finished product. Ice cream so affected is unpalatable and unsalable.

Sandiness in ice cream has been a source of worry ever since the manufacturer recognized the possibility of increasing the total solid content of the ice-cream mix by the addition of milk-serum solids obtained from condensed milk or powdered milk. It was evident that this practice would increase the profits because of the improved condition of the finished product, the increase in overrun, and the replacement of some of the fat in the mix with cheaper milk solids. Additional serum solids made it possible for the manufacturer to make a desirable product from a mix having a lower fat content.

Coincidently, the origin of sandy ice cream dates back to the inception of condensed milk as an ingredient in the ice-cream mix. The first cases of sandiness that occurred were baffling. Sandiness appeared in almost every locality where condensed milk was used. It was not consistent in its appearance. One retailer might report a case of sandy ice cream, while another dealer supplied from the same source might not. Ice cream which became sandy in the retailer's pack but which did not become sandy in the hardening room offered another problem. Usually sandiness was not noticed until the ice cream was a few days old. Sometimes it occurred in the hardening room before it went out to the trade, but more often it occurred after having been placed in a retailing cabinet.

Although the cause of sandiness was baffling, one thing was certain—sandiness was unknown until condensed milk was used. When condensed milk was eliminated from the mix the trouble ceased. Not wishing to return to earlier practices for obvious reasons, the ice-cream manufacturer continued to add the extra serum solids cautiously, at the same time making note of all conditions relative to sandy occurrence.

Inasmuch as the cause was attached to the condensed milk, examinations were made of some samples of condensed milk. In some samples of highly condensed milk crystals were found which had the characteristics of sand. Condensed milk containing these crystals has been termed "sandy" by Hunziker (1). These crystals were more often found in the bottom of containers which had stood at a low temperature. Some believed sandy ice cream was caused by adding these crystals to the mix before freezing; others found that Pasteurization of the mix eliminated these crystals. Reducing the concentration of the condensed milk tended to decrease sandy occurrences for a time. In the course of a short time, however, sporadic cases occurred which increased the worries of the manufacturer.

The only remedy for the difficulty seemed to lie in decreasing the amount of milk-serum solids added to the mix, and in more rapid consumption of the ice cream. This was apparently the only remedy if condensed milk was to be used. The remedy worked very successfully until a spell of cool or rainy weather occurred, causing the ice cream to be held longer in the pack, a condition which favored sandiness. Epidemics of sandy ice cream often followed prolonged cold spells.

CAUSE OF SAND CRYSTALS.

Up to this time no sure or certain relief from this trouble was in sight. Almost every theory had been disproved. The first investigator to offer real enlightenment on the subject was F. H. Bothell (2). This investigator experienced the trouble from the beginning. His first important contribution to the cause was to offer experimental proof that the sandiness was the result of crystal growth at low temperatures subsequent to the freezing of ice cream. He mentioned that any crystals or sandiness existing in condensed milk before addition to the mix would dissolve on Pasteurization of the mix, though they may reappear after freezing. He added that these crystals were lactose crystals, though no proof of this statement was offered. Another point brought out by this investigator was to the effect that the concentration of condensed milk added to the mix was not so important as the amount of serum solids added in the condensed milk. He pointed out that decreasing the concentration of condensed milk while still using the same gallonage may eliminate the trouble, but this would be due to lowering the amount of serum solids added.

It appeared now that a solution was found for the difficulty which had become so widespread, but it was a year before a complete proof was presented fixing firmly the cause of the sandy crystals and associating it with the lactose of the condensed milk. Zoller and Williams (3) isolated the crystals and examined them microscopically. They worked with a mix containing 10 per cent fat, 14 per cent sugar, and 12 per cent serum solids. The raw products were 40 per cent cream (ripened), evaporated skim milk, and pure cane sugar. The mix was frozen with a 10° F. brine, and the ice cream packed in 2-quart tins and placed in the hardening box. The tins were unpacked every other day, and on the fourth day fine crystals appeared. The cans of ice cream were "heat shocked" by setting them in contact with air for 20 minutes, causing the crystals to grow larger. The crystals grew in size throughout 20 days. Upon examination these crystals were found to have the characteristic shape of lactose hydrate crystals. These crystals present a wedge-shaped or tomahawk-shaped appearance. These authors experimenting on crystallization of lactose noted with interest "the rapidity with which these crystals formed in the presence of complex protective substances which ordinarily tend to check crystallization of many other compounds." Such complex protective substances as colloids, acid, and cane sugar were referred to. The Purdue Station (4) reported in 1920 some evidence that sandy occurrences may be inhibited by certain gums, gelatin, and coagulants. The work done indicates that these substances acted as protectors against crystal growth. The writer will refer to this phase under the heading "Experimental."

Thus far the cause of sandiness in ice cream has been established beyond doubt. The next important item is to consider what factors will influence the occurrence of the crystals. Zoller and Williams have already stated that heat shocking helped materially to cause greater and more rapid crystal growth. Evans (5) explains this phenomenon as an "increase of diffusibility, resulting consequently in a more rapid formation of lactose crystals."

The concentration of milk sugar in the mix offers another angle of observation. Bothell chose 10 per cent lactose, based on the water of the mix, as the maximum amount to use. He used this figure because he found that this concentration of pure lactose in water gave no crystals when frozen. Williams (6) placed 5.85 per cent lactose, on the basis of total mix, as the maximum to use. In another paper (7) the writer recommended 10 to 12 per cent serum solids as the maximum amount for a mix containing 12 per cent fat, 14 per cent sugar, and 0.5 gelatin, based on the total mix. The mix containing 10 per cent serum solids would contain 5.41 per cent lactose on the basis of the whole mix, and 8.52 per cent on the basis of the water. The mix containing 12 per cent serum solids would contain 6.49 per cent lactose on the basis of the total mix and 10.55 per cent on the basis of the water in the mix. The latter mix would be in danger of becoming sandy in a shorter time.

To set a definite standard which will satisfy all conditions and mixes can not be recommended at this time. Mixes vary in amount of different ingredients, which makes this difficult. If a given amount of lactose on the basis of the mix is satisfactory in one case it may not be in another, since the per cent on the basis of water may vary. Table 1 bears this out.

TABLE 1.—*Two mixes containing the same lactose content but varying in per cent of lactose on the basis of the water in the mix.*

Mix No.	Fat.	Solids not fat.	Sugar.	Gelatin.	Total solids.	Lactose on basis of mix.	Lactose on basis of water.	Lactose on basis of solids.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	8	10.8	12	0.5	31.3	5.84	8.5	18.6
2	14	10.8	15	.5	39.5	5, 84	9.6	14.8

It will be noted that both mixes represent about the extreme amounts of fat and sucrose for practical mixes. Both, however, contain 5.84 per cent lactose on the basis of the total mix, but do not contain the same amount of lactose on the basis of the other ingredients, such as water and total solids. The mix No. 2 would be in danger of becoming sandy sooner than mix No. 1. In the first place, there is more lactose in the water of the mix, and, in the second place, the total solids are higher, causing more substances, such as the sucrose, to compete for the same water as the lactose.

SOME PROPERTIES OF LACTOSE.

Zoller and Williams's explanation of sandiness is based on knowledge of the properties of lactose. To quote:

> The solubility of lactose in water at 10° C. is about 17 grams per 100 grams of water. The solubility of sucrose at 12° is given as 198.6 grams in 100 grams of water. When these solutions are cooled they become supersaturated, provided they contain the above-mentioned quantities of the respective sugars. In case of lactose, because of its low solubility in water compared with sucrose, it is more difficult to form supersaturated solutions of any great magnitude. When its solutions are concentrated it crystallizes without much excitation.

That the solubility of lactose in aqueous solution is affected by temperature has been demonstrated also by Hudson (8) as follows:

TABLE 2.—*Solubility of lactose.*

Temperature.	Solubility.	Temperature.	Solubility.
° C.	*Per cent.*	*° C.*	*Per cent.*
0	10.65	49	29.85
15	14.50	64	39.75
25	17.80	74	46.35
39	24.05	89	58.15

From the above table it is seen that the final solubility of lactose is 10.6 per cent at 0° C., or 32° F. This table shows the importance of keeping the lactose content below 10.6 per cent at 0° C. In ice-cream making this amount would usually cause sandiness, since ice cream is cooled many degrees below 0° C. when held in the hardening room.

Evans (5) was the first investigator to study the solubility of lactose at low temperatures. The temperatures used by Evans corresponded to temperatures maintained in hardening rooms, namely, —18° C., or 0° F. Those data are recorded in Table 3.

TABLE 3.—*Concentrations of lactose at 18° C. at different ages.*

Original lactose concentration of solution.	Lactose concentration after 48 hours of freezing.	Lactose concentration after 96 hours of freezing.	Lactose concentration after 1 to 4 hours of freezing.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
5	4.99	4.77	4.92
7.5	7.49	6.86	7.29
10	9.68	8.66	9.41
12.5	11.49	10.27	12.01
15	13.25	12.17	12.45
17.5	13.60	13.40	13.84

The crystals obtained from the low-temperature study were not sphenoidal in shape, but rather prismatic and smaller. This was described as being due to forced crystallization rather than from temperature effects. Bothell noted that lactose solubility was noticeably greater in lactic-acid solutions than in neutral or alkaline solutions. He also noted that sucrose added to an aqueous solution containing lactose had an inhibiting effect on crystal growth. Evans confirmed the latter statement, which is shown in Table 4.

TABLE 4.—*Solubility of lactose in sugar solutions held 144 hours at—18° C.*

	Per cent.
Original concentration of lactose	15
Final concentration of lactose alone	12.45
Concentration of lactose with 1 per cent glucose	11.70
Concentration of lactose with 10 per cent glucose	15.00
Concentration of lactose with 1.7 per cent sucrose	12.35
Concentration of lactose with 17 per cent sucrose	15.00

Evans duplicated Bothell's experiment with acid solutions, but used only an amount of acid which could be used in actual practice, and found no noticeable inhibiting effect.

In another experiment in which 2 and 4 per cent of glucose and sucrose were used as inhibitory factors, Evans found no pronounced effect on crystal growth at the end of 14 days at —18° C. In fact the lactose solution containing no foreign sugar showed the least crystal growth. Mojonnier (9), in quoting Travis, showed that lactose was less soluble in 14 per cent sucrose solution than in pure water, and more soluble in ice cream than in water, the difference being due due to the possible effect of "some colloid or colloids in the ice-cream mix."

That colloids have no apparent retarding effect on crystal growth of lactose solution was pointed out by Evans and by Zoller and Williams.

EXPERIMENTAL.

Much space has been taken up in this paper in delving into the history of sandy ice cream. It is a lamentable fact that with the exception of a few outstanding papers there has been very little experimental work published on the subject. The object of this paper is to present a few experiments as well as to give a review of the subject of sandy ice cream. Some of these experiments were done at the dairy division, University Farm, St. Paul, while cooperating with R. D. Evans, who at the time (1922) was experimenting on factors influencing the lactose crystallization in the occurrence of sandy ice cream.

PLAN OF EXPERIMENT.

The plan of the experiment was to study factors influencing lactose crystallization in ice cream. The factors studied were grouped as follows:

1. The effect of other sugars on the occurrence of sandiness.
2. The effect of colloids and other complex substances on the occurrence of sandiness.
3. The effect of degree of concentration of lactose on the occurrence of sandiness.
4. The influence of holding temperature on the occurrence of sandiness.

Before beginning the actual experimental work, it was deemed advisable to adopt an experimental mix, a mix in which the lactose content was sufficient to insure the production of sand. The lactose content was figured to contain no more than 10 per cent lactose on the basis of the water in the mix.

The experimental mix consisted of the following:

	Quantity (pounds.)	Fat.	Serum solids.	Sugar.	Total solids.
Cream, 18 per cent fat	67	12.06	4.9		16.96
Sugar	12			12	12
Pure lactose	3.8				3.8
Gelatin	.5				.5
Water	16.7				

The experimental mix contained a very small amount of serum solids, so the additional lactose was supplied from pure commercial milk sugar. The added water of the mix was used as a solvent for the lactose and as the water in which to mix the gelatin. This mix contained 6.45 per cent lactose on the basis of the weight of the mix and 9.66 per cent lactose on the basis of the total water of the mix.

Preliminary experiment.—The purpose of the preliminary experiment was to observe the occurrence of sand in the experimental mix, and to note the conditions of manufacture, holding, and packing, so that the processes could be duplicated identically in subsequent experiments.

The mix was made from cream 36 hours old, Pasteurized at 145° F. for 30 minutes, aged 24 hours, frozen, and placed in the hardening room. Two days later two 6-quart containers were packed in salt and ice under cabinet conditions.

The temperature of the hardening room fluctuated considerably at first, due to the small amount of product in storage. The temperature of the hardening room ranged from −10° F. to 10° F. The temperature of the ice cream in the cabinets fluctuated from 5° F. to 20° F., and at times the cream became somewhat soft. Sandiness appeared in these cabinets at the end of 8 days. The crystals were examined microscopically and identified as lactose hydrate. Crystals occurred at the end of 19 days in the hardening room.

EFFECT OF OTHER SUGARS ON THE OCCURRENCE OF SAND.

Dextrose or glucose.—It has been stated often that sucrose, glucose, and corn sirup in the mix would tend to inhibit sandiness. The experimental mix was recalculated to contain dextrose in an amount equal to 25 per cent of the sucrose. This was used to substitute 25 per cent of the sucrose. The dextrose which was used imparted a slight caramel color to the mix but did not alter the flavor any. The mix was prepared and treated as in case of the previous mix, except that this mix and all subsequent mixes were homogenized at 2,500 pounds pressure. Sandiness was noted in the cabinets at the end of 1 week. None appeared in the hardening room. This experiment was repeated later, and in this experiment sand occurred as usual in the pack and in the hardening room in 15 days.

Corn sirup.—Corn sirup was added to replace 50 per cent of the cane sugar in the experimental mix. The mix contained the same solid ingredients as the experimental mix. Less water was used because of the water in the sirup. The samples of ice cream in the pack or under cabinet conditions became sandy in 7 days and those in the hardening room in 10 days on the average.

Cane sugar.—The sugar or sucrose content of the experimental mix was increased to 14 per cent. The total solid content was consequently increased to 35.26 per cent, thus lowering the amount of water in the mix by an amount equal to the additional sucrose or cane sugar.

The ice cream was made in the manner of all the previous mixes. Sandiness occurred in the cabinet at the end of 10 days and in the samples in the hardening room in 7 days. The experiment was later repeated and sandiness occurred in 8 days in cabinet and 14 days in the hardening room.

EFFECT OF COLLOIDS AND OTHER COMPLEX SUBSTANCES ON THE OCCURRENCE OF SAND.

Mention has been made in the literature of protective colloids and their effect on sandiness. The colloids chosen for this experiment were gelatin, because of its low gold number and because of its importance in ice-cream making as a stabilizer, and the colloids of milk.

Gelatin.—The amounts of gelatin used in these experiments were 0.5 per cent, 1 per cent, and 2 per cent. Normal mixes usually contain about 0.5 per cent. More than this amount results in a "livery" mix. The mixes were constructed to vary only in their gelatin content, which caused the water content to vary accordingly. The occurrences of sand are listed below:

TABLE 5.—*Occurrence of sandiness in mixes of high gelatin content.*

Gelatin.	Time before sand appeared.	
	In hardening room.	In pack.
Per cent.	*Days.*	*Days.*
0.5	10	5
1	21	10
2	26	10

Milk-serum solids.—One of the reasons for choosing an experimental mix was for the purpose of studying the influence of milk solids not fat which could be supplied by using condensed or powdered milk and which would not alter the total lactose content of the mix. The mix had to be recalculated to contain the same amount of lactose on the basis of water, but to have more serum solids. The following mix was used:

	Pounds.
Cream (20 per cent fat)	60
Sugar	12
Skim powder (97 per cent total solids)	5.55
Gelatin	.5
Skim milk	21.95

The lactose content of this mix was 6.27 per cent on the basis of the mix and 9.8 per cent on the basis of water. Sand occurred in the hardening room in 22 days. Unfortunately the sample held in the pack or under cabinet conditions was destroyed before the occurrence of sandiness was noted. When repeated later, sand occurred in 9 days in the pack and 19 days in the hardening room.

Rennet.—Rennet extract was added after the mix was Pasteurized and cooled to 85° F. The mix was later placed in the cool room at 40° F. to age. After 24 hours it was frozen. The amount of rennet used far exceeded any amounts needed to coagulate milk for cheese making. It was added at the rate of 10 cubic centimeters for each

10 pounds of mix. Sandiness occurred in the cream under cabinet conditions in 7 days and in the hardening room in 11 days.

EFFECT OF THE DEGREE OF CONCENTRATION OF LACTOSE ON THE OCCURRENCE OF SANDINESS.

So far in this paper the experimental work has been confined to the study of factors influencing the occurrence of sand. Inasmuch as no inhibiting factors were discovered which would offer a practical solution to the problem of sandy ice cream, it was deemed necessary to ascertain about what amount of lactose could be used in practical mixes without danger from sand when the ice cream is held several days under cabinet conditions.

Mixes were constructed containing from 7.2 to 12 per cent serum solids. Previous experiments mentioned showed that it was possible to obtain sandiness in mixes containing 11.5 per cent serum solids. Condensed milk was used to supply the additional lactose or added milk solids not fat. No sandiness was experienced until the serum-solid content was increased to 10.2 per cent of the mix. The sandiness occurred only in the pack in this case. The ice cream held in the hardening room did not develop sandiness after several weeks. It appears from this experiment that 10.2 per cent serum solids would be the maximum to use without severe danger from sand in this particular mix. The per cent of lactose on the basis of water in this mix was 8.7 per cent. The total solid content was 36.5 per cent.

EFFECT OF CONSTANT SERUM SOLIDS OF THE MIX, WITH VARYING TOTAL SOLIDS, ON THE OCCURRENCE OF SAND.

To set a given amount of serum solids as the maximum to use would be impracticable, inasmuch as different mixes may have the same serum-solid content and the same per cent of lactose on the basis of the mix, but still have a varying lactose content based on the water of the mix. To study this point two mixes were computed. Those mixes are given in Table 1. Powdered skim milk supplied the additional serum solids. Sandiness occurred in mix No. 2 in 8 days in the cabinet, and 15 days in the hardening room. No crystals occurred in the hardening room in mix No. 1 after 5 weeks, at which time the experiment was discontinued. Some indications of sandiness appeared in a sample which was heat shocked several times at the end of 5 weeks.

THE EFFECT OF TEMPERATURE AND TIME OF HOLDING THE ICE CREAM ON OCCURRENCE OF SANDINESS.

That the temperature at which the ice cream is held has a decided effect on lactose crystallization has been pointed out by Williams (6). Samples of ice creams studied were held at two different temperatures, namely −10° F. to 10° F. in the hardening room, and 5° F. to 20° F. in the pack or cabinet. Table 6 indicates the results of these trials.

TABLE 6.—*Influence of holding temperature on the occurrence of sandiness.*

Mix No.	Time until sandiness occured.		Mix No.	Time until sandiness occured.	
	In hardening room.	In cabinet.		In hardening room.	In cabinet.
	Days,	*Days.*		*Days.*	*Days.*
1	19	8	6	21	10
2	7	10	7	26	10
3	0	7	8	11	7
4	12	7	9	0	6
5	10	5	10	15	7

Heat shocking—By heat shocking is meant the practice of permitting the frozen ice cream to become slightly softened by exposure to warmer air, and immediately frozen again. This was practiced on the experimental mix for 3 days. Sandiness occurred in that sample in the hardening room in 6 days, while a sample of the same mix not treated did not show sand in hardening until the nineteenth day; one under cabinet conditions did so in 8 days. All mixes subjected to heat shocking produced similar results. All lots kept in cabinets were shocked more or less, since the ice cream was usually somewhat soft when repacked. All cabinets were repacked in the morning and late in the afternoon. The long period from 5 p. m. until morning usually caused the ice cream to become slightly soft. The ice capacity of the cabinets was not large enough to insure absolute firmness of the ice cream all of the time.

DISCUSSION AND CONCLUSIONS.

It will be noted that in the first experiment where sugars were used as inhibiting factors there was no pronounced effect. It has been stated by practical investigators that high sugar content caused the precipitation of lactose to become less and in some instances prevented it entirely. This view was not borne out in these experiments. The additional sugar in the mix from sources such as sucrose, glucose, and sirup increase the total solid content of the mix and at the same time decrease the available water for holding the lactose in solution, and competes for the water of the mix. The more sugars and other solids added, then, while the per cent of lactose on the basis of the mix remains constant, the higher will be the concentration of lactose in the water of the mix.

Colloids have but little if any commercial value in protecting against lactose precipitation. This conclusion bears out the work of other investigators previously mentioned. The amount of gelatin necessary to delay somewhat the occurrence of sand is too great to be of any practical use.

It was also noted that rennet offered no inhibiting influence on lactose crystallization. Rennet acts on the casein of milk and causes a coagulation or gelation under normal conditions. It is doubtful if this could happen at the low temperatures to which these mixes were subjected. In the coagulation of casein we have syneresis, which may tend to encourage the precipitation of lactose rather than to inhibit it.

The degree of concentration of lactose in aqueous solution is by far the greatest single factor in the formation of sand. It is possible to have a lactose content on the basis of the mix which may give sand in one case and not in another. This depends on the per cent of total solids, or on the other hand the per cent of water in the mix. More lactose can be supplied from condensed milk or milk powder in a low-solid mix than in a high-solid mix without danger from sand. A mix containing 10.8 per cent of serum solids, with 14 per cent fat and 15 per cent sugar, will be in danger of becoming sandy in time. A mix containing the same amount of serum solids, with 8 per cent fat and 12 per cent sugar, will not be in such danger of becoming sandy. A mix containing as low as 8.7 per cent lactose based on the water of the mix became sandy under conditions which favored sand occurrence, such as temperature changes or heat shocking. While it was possible to produce sandy ice cream in ice cream having as low as 8.5 per cent lactose in the water of the mix, this amount could not be considered as dangerous, since the time required to produce this sandiness in these instances was much longer than the time the manufacturer usually holds ice cream.

High temperature ranks next to lactose concentration in importance as a factor inducing sandiness. Whenever the ice cream was packed in cabinets where the temperature could range between 5° and 20° F. there was found a more rapid formation of sand. A temperature of —10° F. to 10° F. in the hardening room prevented the crystals from forming so soon. This has been explained as being due to the faster rate of diffusion in soft ice cream. The rate of diffusion of lactose is very much slower when a lower temperature is maintained. A constant low temperature (0° F.) gave better results than temperatures which fluctuated between —10° F. and 10° F.

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SESSION 11. METHODS OF IMPROVING AND PROTECTING THE MILK SUPPLY.

Honorary chairman, NICOLAS CHAVARRIA MORA, engineer, San Jose, Costa Rica.

Chairman, IVAN C. WELD, secretary-treasurer, International Association of Dairy and Milk Inspectors, Washington, D. C.

Secretary, Dr. C. L. ROADHOUSE, professor of dairy industry, University of California.

FIRST BAPTIST CHURCH ASSEMBLY HALL,
Syracuse, N. Y., Saturday, October 6, 1923—9.30 a. m.

Chairman WELD. We have come together this morning to discuss some of the important phases in the control of qualities and in the protection of the milk supply of the people. We have about seven foreign countries represented here as well as our own. I hope that information will be developed during the morning which can be carried by you to your respective States and countries, and which will serve the most useful purposes in the protection of your people.

I take great pleasure this morning in being able to introduce to you our honorary chairman, Nicolas Chavarria Mora, former Director General of Public Works, Costa Rica. [Applause.]

Honorary Chairman CHAVARRIA MORA. Ladies and gentlemen: I wish to express my cordial thanks to the executive committee of the World's Dairy Congress for the honor they have bestowed upon me in designating me honorary chairman for the eleventh session, and it is in this capacity that I have the honor of addressing to you a few words in my broken English, which I beg you to excuse.

As you well understand, I am not going to speak about the "Methods of improving and protecting the milk supply," which is the subject of this session. Prominent technical men, as stated in the program, will discuss this interesting subject, which is of real and actual value to our Latin American countries, where, with very few exceptions, the dairy industry is still in its infancy. That is just the reason for our coming to your country, taking advantage of the kind invitation extended by the Government of the United States of America to our own governments to attend the sessions of the World's Dairy Congress, whose work is of capital importance, not only for North America but for every nation in the world.

People of every country come to the United States to learn how to make laws and how to respect them, to pay homage to your forefathers—the fathers of this wonderful Republic, whose place among the civilized nations is in the front line; to admire the warm patriotism of all the citizens of the United States of America; and to inquire into your wonderful material progress as represented by your extensive and well-equipped railways, your magnificent highways, your remarkable sanitary works, and your monumental public buildings and memorials.

We come here to learn many things connected with the dairy industry, such as the nutritional value of milk, the methods of educating the public to the use of milk, milk in the diet, city milk problems, the chemistry and bacteriology of milk, the control of the quality of milk. Many other aspects of the subject are of great importance to us as matters of public hygiene, tending to protect the health of people and particularly the lives of children. This is the most Christian duty of rulers of peoples and the best means to increase population. This is one of the most important needs of our young Latin American republics. I thank you. [Applause.]

Chairman Weld. I am sure we all respond most cordially to Doctor Chavarria's generous sentiments. We all hope that this session will contribute to the advancement of sanitation and industry in this and other lands.

A question which has confronted many municipalities and has confronted all of us is how we can efficiently control our milk supply. This question will be the subject of a paper presented by Dr. C. J. Hastings, medical officer of health, Toronto, Canada. [Applause.]

HOW CAN WE BEST SAFEGUARD OUR MILK SUPPLY.

Charles J. Hastings, M. D., C. M., L. R. C. P. I., LL. D., D. Sc., medical officer of health, Toronto, Canada.

There are two activities in connection with every department of public health that are prerequisite to anything approaching efficient administration. These are the safeguarding of the water supply, and the safeguarding of the food supply, with special reference to milk. Any community failing in these two activities is guilty of criminal negligence, inasmuch as sins of omission, in public health administration at least, are no less culpable than sins of commission. From 50 to 75 per cent of all infants dying from diarrheal diseases should have their death certificates filled out "poisoned by milk." There is not a necropolis, not a graveyard, in this country, or probably in any other country, that is not dotted over with little gravestones, tombstones, and monuments marking the graves of those whose lives have been sacrificed to impure milk.

The late Sir William Osler, regius professor of Oxford, when visiting the home of his birth several years ago, met an old schoolmate. She was married and her dress gave evidence of recent bereavement. They entered into conversation, recalling their boyhood and girlhood days at the preparatory schools. Sir William asked her if she were married; she replied that she was. "How many children have you?" "I have had seven; five of them have died." Sir William naturally inquired the cause of death, to which she replied "Cholera infantum, summer complaint," etc. "However," she continued, "I have been quite reconciled that it was the will of Providence to take them away." After a brief pause, Sir William said, in his usual frank way, calling her by name: "Mary, Providence had nothing to do with it. Your children were poisoned by impure milk."

The universal ignorance, until recently, of the dangers of impure milk has been pitiful. One occasionally sees evidence of this ignorance in the actions of presiding magistrates or judges in our different courts. Recently a presiding magistrate in this country, after evidence had been given as to carelessness in connection with the production of milk, and the prosecution of a certain vendor for having offered for sale impure milk containing barnyard contamination, said: "Oh, yes; I hear much about this impure milk. It seems to me that the cow would have to have a bath every time before milking in order to have clean milk," and there was no conviction. Such expressions of opinion, such expositions of ignorance, promptly place such presiding magistrates or judges in the class of those who occasionally rush in where angels fear to tread. A decision of such character from a magistrate in my city would call forth such ridicule from our department that the bench would decide to think in the future before handing down judgment. I have a profound respect for the bench, but only in so far as the presiding magistrate or judge merits it. The bench is not always omniscient.

Probably no other phase of preventive medicine has engaged the attention of public health administrators, for the past 10 years at least, to a greater extent than has the efficient safeguarding of the public milk supply; advisedly so, for in a modified form, it is the only efficient or reasonably efficient substitute we have for mother's milk. There is no other food comparable in value for invalids; in fact it should enter largely into the diet of all. Milk in some form, and its products, butter, cream, cheese, ice cream, are among the most important articles used for human food and constitute a large percentage of the food used by civilized man.

Education, legislation, cooperation, and administration would seem to constitute the chief cornerstones upon which to construct a permanently efficient milk control. In our educational campaigns we must endeavor to enlighten our citizens, first, in regard to the food value of milk; and, second, in regard to the dangers lurking in ordinary market milk; the enormous possibilities of contamination; the character of these contaminations, and the best ways and means of safeguarding the milk. Nine-tenths, if not nineteen-twentieths, of the permanent efficiency of all public health administration is obtained through education. The same is obviously true of our milk control, which necessarily constitutes one of the most essential parts of public health administration in any community. It must be apparent that we can not hope to have efficient legislation without arousing public sentiment to the necessity for it. Consequently we must demonstrate to our citizens that milk is the most valuable article of food we possess, that modified cow's milk is the most efficient substitute we have for mother's milk, inasmuch as it is in itself a perfectly balanced diet. However, it is well to note that whether or not milk contains all three of the necessary vitamins or accessory food factors, depends on the food of the herd. In order to secure this perfect food, properly balanced, the fodder for the herd must always contain these vitamins.

In addition to this, we must also demonstrate that milk constitutes the most efficient food we have for invalids, and that, in fact, the developing boy and girl should consume at least a quart of milk every day, in order to supply that which is essential for perfect physical development, and every adult should consume daily at least a pint of milk, to maintain those essentials. And, furthermore, we must demonstrate that milk is the most economical food we have, that with the addition of bread or cereal it constitutes a perfectly balanced diet even for the adult, not only supplying heat and energy but also tissue.

One of the most valuable by-products of the war that we have just passed through is the wealth of information that has been furnished us in regard to the relative values of foods, the necessity for a balanced diet, and the knowledge of the importance of accessory food factors or vitamins, which are now known to be so essential for a properly balanced diet.

DANGERS OF MARKET MILK.

It is a well-recognized fact, fully demonstrated, that ordinary market milk is a very significant source of the transmission of disease germs to man; in fact, milk constitutes the channel through which probably more disease is transmitted than all other foods and drinks combined, inasmuch as we have to contend not only with one particular disease, peculiar to both the dairy cow and to man, but also with the possibilities of transmission of other communicable diseases through contamination by those persons handling the milk.

BOVINE TUBERCULOSIS.

The late Professor Koch, to whom we are indebted for the discovery of the tubercle bacillus, which is responsible for tuberculosis, for years maintained that this germ in man and beast was identical. However, in 1901, at the International Congress on Tuberculosis, held in London, Koch took the stand that bovine tuberculosis was harmless to man. This statement was regretted by many. It came like a bolt from the blue. However, in my judgment, it was probably one of the most valuable statements that Professor Koch ever made, inasmuch as I question whether we would have been placed in possession of the indisputable evidence of the dangers of this disease to man at as early a date as we were had it not been for this incident. Immediately following this convention, at which Koch promulgated this opinion, commissions were appointed by England, Germany, France, and the United States, authorized by their countries to investigate and report findings to the congress at its next meeting. The findings of these various commissions were intensely interesting, as they practically all demonstrated beyond question that 25½ per cent of all cases of tuberculosis in children under 16 years of age is of the bovine type, and is transmitted, for the most part, through the medium of milk.

SOURCES OF CONTAMINATION AND HOW TO PREVENT THEM.

In addition to bovine tuberculosis as a menace to man, numerous outbreaks and epidemics of diphtheria, scarlet fever, typhoid fever, septic sore throat, and, in fact, practically all communicable diseases, have been traced directly to the milk supply. Yet this is all preventable by scientific Pasteurization. Obviously, then, the failure to adopt the necessary means of preventing these diseases by any community or municipality surely means criminal negligence on the part of the authorities. Milk supervision must begin with the cow, and the environment of the cow, and end with the consumer. From the cow's udder to the infant's stomach there are from 20 to 25 possibitilies of contamination of this most valuable food and the most important source of contamination, or responsibility for contamination, is the man. It is surprising what an excellent quality of milk can be procured from uninviting surroundings, providing the man in charge of the production of this milk, and responsible for it, has an aseptic conscience and a proper conception of personal hygiene, personal cleanliness, and of his obligations to his fellowmen in doing his bit toward preventing the spread of the aforesaid communicable diseases.

With a well-organized milk supervision from the cow to the consumer we can guarantee a clean milk supply, for the most part free from barnyard contamination. However, it must be remembered that this does not mean a safe milk supply. The milk of any community can be made safe at all times only by rendering it bacteriologically clean or bacteriologically safe by scientific Pasteurization; that is, raising the temperature of the milk to 145° F., and holding it at that temperature for thirty minutes, and then promptly chilling to 45° F., and retaining it at or about that temperature until delivered to the consumer. This process will destroy all disease-producing germs without materially changing the nutritive value, chemical composition, or digestibility of the milk. However, we must first insist that all milk be free from barnyard contamination, free from all mechanical sediment, as demonstrated by the sediment test, before we can consider it suitable milk for Pasteurization, bearing in mind that Pasteurization will not make dirty milk clean. Pasteurization is intended only to make clean milk bacteriologically clean. Pasteurization must be made safe by installing self-registering thermometers of an approved type in connection with every Pasteurization plant, or in other words, "making the process fool-proof." In Toronto these self-registering thermometers are owned and controlled by the department of public health, and we carry the keys. They are so constructed that they can not in any way be tampered with. We have had all of them tested by the Federal Government authorities at Ottawa, and we have them retested from time to time by a thermometer that is known to be accurate.

OBJECTIONS RAISED TO PASTEURIZATION.

The objections to Pasteurization are for the most part a pitiful exposition of ignorance on the part of the objectors, and consequently when I refer to the advisability or inadvisability of Pasteurization, I do so with apologies to my colleagues, especially those on the commission of milk standards, to whom the discussion of this problem is ancient history. No one who has been making a scientific study of the milk problem and who is, therefore, in a position to give an intelligent opinion, has, within the past 15 years at least, questioned for a moment the advisability of Pasteurization of all milk for infants and children, and even for adults. This is true especially if the milk does not come up to the standard required for certified milk, and even certified milk should be Pasteurized in order to make it at all times safe.

In all the advances in science there are always a few persons who can not keep pace with the advancement, and they expect others to wait for them. As Sir William Osler expressed it, it is necessary therefore to reiterate, reiterate, and reiterate, and continue, until the densest mind has been able to appreciate the indisputable evidence.

It is true that there is one argument against Pasteurization that may be raised and that is that the process of Pasteurization affects, in a degree only, the antiscorbutic vitamin. However, it has no other ill effects on the milk, either in regard to its chemical composition, its food value, or its digestibility. Also, even this antiscorbutic vitamin is not a stable constituent of milk and its presence depends greatly, as already pointed out, on the fodder of the herd. Furthermore, any little ill effects that may result from Pasteurization in this respect can be promptly eliminated by the administration of orange juice or tomato juice, both of which are abundantly rich in the antiscorbutic vitamin. All modern pediatritians recommend that, as a routine, infants be given a certain amount of orange juice every day; but no amount of orange juice will counteract or destroy the results of contamination of milk by the various disease-producing germs. There have been between 500 and 1,000 outbreaks of typhoid fever, scarlet fever, diphtheria, septic sore throat, as well as other communicable diseases on this continent within the past few years. These particular outbreaks or epidemics would never have occurred if the milk supply had been scientifically Pasteurized.

HOW CAN WE SAFEGUARD OUR MILK?

The control of the milk supply commences with the examination of every animal in the herd. All cows from which milk is to be used for human consumption should be examined by a veterinary inspector of the department of public health, and any animal found to be suffering from any form of disease should be excluded from the herd. A similar inspection should be made of all producing herds on an average of twice a year. It probably will be found impossible or impracticable to apply the tuberculin test to all cows producing milk for any large city. The magnitude of this task must be apparent, but any cows obviously suffering from tuberculosis should be promptly removed from the herd.

The inspection service maintained in the country by a department of health should be of an educational character. The veterinary inspector should assist the farmer in every way possible in the ways and means of producing clean milk, and also advise him of the importance of keeping a separate account for each animal in the herd; the amount of food consumed daily; the amount of milk given daily; the percentage of cream; and the total solids, and in this way, they will be enabled to eliminate from their herd those animals that are intended for beef and not for dairy purposes, which help to reduce materially the profit on any herd. When a farm is visited, the condition of the stables, barn, milk house, cattle, and utensils should all be carefully investigated, as well as the methods of milking; the precautions taken in cleansing the udder and flanks of the cow before the process of milking begins; the subsequent prompt chilling of the milk before it is shipped to the city; and the importance of proper and efficient ventilation, not only to safeguard the milk supply but also to safeguard the animals, thus assuring the farmer that he can not afford to disregard the proper housing of his stock. Especial attention must be given to the efficient screening of all milk houses and the cleansing and sterilization and subsequent care of all milking utensils.

Where the conditions on the farm are such as to convince the inspector that safe milk can not be produced at all times, the supply should be excluded from the city. No procedure is more effective in having a producer comply with the requirements of a department of health than to exclude his supply until such conditions are corrected. To the credit of the farmers, I might say, it has been our experience that a great majority of them welcome the inspectors and carry out their suggestions quite willingly. A certain number do not. However, if after repeated efforts to improve, the requirements of the department of public health are not carried out, these men are promptly excluded. We are careful not to require anything of a producer in the form of any unnecessary expense in connection with his buildings or equipment. There are a few things which should, however, be insisted on, such as tight flooring; clean whitewashed stables, with efficient light and ventilation; a separate milk house, lighted and used for milk only; an adequate supply of cold water or ice for chilling the milk is also most essential. Other animals must not be allowed in the dairy stables. Throughout the whole inspection service, the fact should be particularly emphasized that the production of clean milk is dependent for the most part on the clean habits and sanitary conscience of the producer.

There are, of course, a certain number of producers who will not meet the requirements until pressure is applied, although fortunately this number diminishes year by year. In some instances it will be found that inspectors have repeatedly asked that certain minor improvements be made, and that even letters from the office have produced no response; but within 24 hours after exclusion, frequently long-distance telephone calls from producers have been received. stating that cows have been clipped, or stables have been whitewashed, or some similar requirement complied with which they had failed to carry out before.

It is extremely important to have every dairy farm intending to ship milk to the city inspected before any milk is received, in order that a farmer may not be able to ship dirty milk for several weeks before the inspector visits his farm. When a producer has been excluded for dirty milk or insanitary conditions on the farm, a reinspection should always be made before he is allowed to resume shipping. At this inspection the inspector should insist that everything the farmer has been asked to do before has been complied with, and usually few who ask for reinspection find the demands of the department of health at all burdensome.

A great deal of the milk supply of every city, in recent years, comes through shipping stations. In the case of Toronto, approximately 25 per cent of the milk supply of the city is sent through stations. In most of these shipping stations the milk is pooled daily and shipped in refrigerator cars to the city. In others, the milk is chilled in the original cans and then reshipped. In the stations where all milk is pooled or mixed, it is quite evident that the identity of the milk is lost, so that it has been necessary for inspectors to visit these stations to make sediment tests and to take samples for butterfat and bacterial count. This is usually done with the assistance of the veterinary inspectors of the particular districts. The sediment disc, taken on the spot and in the presence of the producer and his neighbors, forms a very striking object lesson on clean and dirty milk production. When inspectors stay two days or more at a station, the improvement among the careless shippers is usually quite marked. Pressure should be gradually brought to bear on these shipping stations to control their own supply more adequately, and our experience in Toronto, at the present time, is that some of our shipping stations are shipping the cleanest milk that is being sold in the city, inasmuch as they are making the necessary demands on the farmers sending the milk to their particular stations. While these shipping stations have the disadvantage of compelling supervision of the supply some distance out of the city, they have a much greater advantage, which offsets this, and that is, that the milk is chilled thoroughly and held cool until delivered to the city.

Part of the supply from the area adjoining the city comes in trucks. These trucks must be covered to keep the milk cool in summer, and they should be inspected regularly to see that this is done, and also to see that they are not bringing in milk from excluded farmers to dairies other than those to which the supply was formerly sent.

CONTROL OF DAIRIES WITHIN THE CITY.

It is at the dairies in the city that a large part of the control of the milk supply itself must be exercised. We require the dairies in the city to own and control all milk cans. After these cans are emptied they are thoroughly washed and sterilized by means of live steam and then sealed before being sent back to the farmer. When the farmer is prepared to pour milk into them, and not until then, is this seal broken, and after he has filled his cans, he again, in turn, seals them before shipping to the city or to the shipping station.

When the milk is received in the city, the first step after agitating the contents of the can, is to filter through a cotton disc a small quantity, usually a pint. The cotton disc, through which this pint of milk is filtered retains all dirt or impurities, which stand out in striking contrast to the white background on which they rest. This sediment test has been of valuable assistance in directing the activities of the outside inspectors to farms where conditions are not satisfactory. Milk which shows any appreciable amount of sediment should be promptly condemned and either stained with a nonpoisonous dye and returned to the farm, or emptied into the sewer. While it is not possible, for obvious reasons, to inspect every can of milk in the city, yet inasmuch as the producer knows that our inspector may open any one of his cans for inspection, he is usually as careful as if he knew that every can was going to be inspected.

The second procedure is the taking of the temperature. This is particularly important in the summer weather, because milk which has reached the temperature of 75° F., or 80° F., we know has not been chilled on the farm; therefore, its bacterial content has increased beyond the point at which Pasteurization is sufficient to make it safe. The temperature of the milk which is received from shipping stations is usually about 50° F., and not more than 55° F. Unfortunately much of the milk coming in by train reaches the city at a higher temperature than this. While the producer must accept responsibility if he has not properly chilled his milk, yet we appreciate the fact that inadequate service on the railways—delay, lack of refrigerator cars and of proper loading platforms—means that a great deal of the milk reaches the city at too high a temperature.

Milk should not under any consideration be received that has been shipped any distance at a temperature over 70° F. However, in many places where there are not proper shipping facilities this will always be a weak link in the system of control.

The third test that is made is for butterfat. Samples of milk are taken from the original cans after careful mixing, and are tested at the laboratory for butterfat and total solids. When there is any occasion for it, tests are also made for preservatives and any adulteration. Fortunately these last two are almost things of the past in Toronto's supply.

The fourth test is made for the bacterial content. Samples are taken, using all precautions to prevent infection, and these are plated in the laboratory. These tests are all made at the laboratory, and the reports of the farm inspector, the dairy inspector, and the laboratory division are all correlated.

When it is found that a farmer is shipping milk that is dirty or below standard, his supply is promptly excluded and not readmitted until he comes up to the standard and in every way complies with the requirements of the department. This is probably the most efficient way of compelling producers promptly to comply with the requirements of a department of public health.

A record of each producer should be kept at the central office, on which should be entered the results of such tests as are taken. In this way the man's past record is available at a glance, and any tendency to slip back after he has had a record of constant improvement can be promptly detected. The same records can also be used for the farm inspectors' reports. In this way the farm inspector before making his inspection, has available all information regarding the cleanliness or lack of cleanliness, and the quality of milk produced; and the head of the division is also in a position to direct the attention of the inspector to all farms from which contaminated milk is shipped.

In the city itself the dairies should be under the constant supervision of a staff of city inspectors. Particular attention should be paid to the general cleanliness of the plant, the thorough cleansing and sterilizing of all apparatus used in handling the supply; piping should be taken down and pumps taken apart from time to time, and all possible lodging places of dirt or bacteria sought. The method of sterilizing apparatus and utensils must also be carefully checked, both practically and experimentally.

The necessity for the installation of self-registering thermometers of a reliable make was fully appreciated when it was found that many dairymen apparently did not realize the necessity for the proper control of their Pasteurizers. Temperatures ranging from

115° to 160°, and a holding period from five minutes to two hours were found. Occasionally our inspectors found men beginning to bottle as soon as their thermometers had reached a temperature of approximately 140°. Consequently the contents of the last few bottles might have been Pasteurized within the accepted meaning of this term, but certainly the great bulk of the milk in the Pasteurizer had been bottled with a maximum holding time of less than 15 minutes. We have now eliminated all possibilities of these irregularities by the installation of self-registering thermometers.

The sterilizing of the coolers and bottle fillers should be closely supervised, and frequent samples should be taken to control the possibility of contamination of the milk subsequent to Pasteurization. To reduce this to a minimum the capping of the bottles must be done mechanically and not by hand. This will remove one most probable source of infection (the human hands) subsequent to Pasteurization.

The adequate supervision of Pasteurization and the subsequent handling of the milk are operations to which the attention of the inspectors must be especially directed. It is to be regretted that, as yet, there is no form of capper available which puts a cover over the top of the bottle, as is done with certified milk, at a cost which would not be prohibitive as applied to the general supply of a large city. The danger of infection of the neck of the bottle or the lip of the bottle with the present type of cap is a real one. Some few outbreaks of communicable disease have been traced to this source.

The milk cans and bottles, when ready to receive milk, are frequently tested by our inspectors. A small quantity of sterile water is poured into the can or bottle; it is then agitated thoroughly; these samples are then poured into sterilized bottles, properly capped, and returned for examination to the laboratory.

When unsatisfactory conditions are found in a dairy, special inspections should be made, and it is usually possible to locate the source of the trouble without a very extended inspection. Dairies, as a whole, will be found to respond very well to the efforts of a department of health, and usually they will take adequate steps to protect their own milk supply, both before and after delivery at the plant.

Inspections should also be made of the wagons in which milk is delivered and of the stores in which it is sold, as only bottled milk should be allowed to be sold. Such inspection can usually be confined to the way in which milk is handled and its refrigeration, although it is sometimes advisable to take samples from bottles to make sure that the same supply is being issued for store distribution as for home delivery.

The milk sold in restaurants requires careful watching. Of course in the better restaurants milk is sold in half-pint or pint bottles, so that the consumer is assured of getting whole milk. In other restaurants, however, the milk is dispensed from a can or through an urn. Unless the contents are frequently and thoroughly stirred, the cream separates, and the last customer gets a much richer milk than the first. There will always be difficulty under these conditions in having the milk frequently stirred before serving. However, a few police court proceedings will usually correct such difficulty.

THE CARE OF THE MILK IN THE HOME.

It must be apparent that, notwithstanding the fact that milk may be delivered to the home clean, absolutely free from barnyard contamination, and made safe by scientific Pasteurization, carelessness in the handling of the milk in the home may make the milk unfit for human consumption inside of 12 hours.

The milk bottle, when taken in, should be carefully washed with warm water and wiped with a clean cloth. After the necessary amount is taken out for use, the remainder should be placed in a refrigerator. In cases where a refrigerator is not available, an improvised ice box can always be made for a few cents. Otherwise the milk may be placed so that it will be in a current of air, with a wet cloth around the container, which should be moistened from time to time, the evaporation materially lowering the temperature of the container; or it should be kept in the coolest possible part of the house. The milk should be so covered as to protect it at all times from dirt, dust and fly contamination, and mothers are warned to wash their hands carefully before beginning to prepare the milk or food for the baby.

Chairman WELD. Is there any discussion of the address of Doctor Hastings?

Doctor HASTINGS. May I call attention to this chain I have on the wall? This chart, or drawing, represents the different links where contamination can take place in the milk from the cow to the consumer.

Mr. C. L. SMITH (Union Pacific Railway). I have noticed when the lid of a milk can is placed on the can before the milk is cooled entirely, there is a putrid odor present. How can that be remedied?

Doctor HASTINGS. That is a very pertinent question and I am glad to have had it brought up. It demonstrates the extreme importance of chilling the milk as rapidly as possible.

Chairman WELD. The next paper on the program will be presented by Dr. G. H. Hart, at the head of the division of veterinary science, University of California, and the subject is "Health department organization in developing a municipal Pasteurized milk supply with a final bacterial count under 15,000." It affords me great pleasure at this time to introduce to you Doctor Hart, of the University of California. [Applause.]

HEALTH DEPARTMENT ORGANIZATION IN DEVELOPING A MUNICIPAL PASTEURIZED MILK SUPPLY WITH A FINAL BACTERIAL COUNT UNDER 15,000.

GEORGE H. HART, D. V. M., M. D., associate professor of veterinary science, College of Agriculture, University of California, Berkeley, Calif.

SCOPE OF THE WORK.

The problem confronting a municipality of the first class in developing a high-quality milk supply still remains a task of major responsibility and difficulty, despite the great aids given in recent years by scientific discovery in both knowledge and technique. The milk shed of a great city covers a wide range of territory and a great many farms. The constant flow of the daily supply from these diverging points, hundreds of miles in extent, through comparatively few central plants, and out again by way of wagons, stores, restaurants, and the home kitchen, to the consumer, is a journey constantly fraught with danger as to quality, and possible disease transmission. I think it is no longer open to argument that all of the milk can not be of the same quality, and, therefore, a grading system is essential to-day in any comprehensive attempt at supervision.

These are matters covering the sanitary side of inspection, and while this is a very big problem, the health of the animal side is one almost, if not equally, as large. Enough thought has not been given to these two factors, both of which are essential to a full appreciation of the work. In too many parts of the world stress has been laid on only one of these phases to the exclusion of the other, and never will the problem be fully settled until both are properly handled. Where the health of the cow has been considered of paramount importance, Utopia in this regard has been far from reached; and where sanitation has been the goal, while progress has certainly been made, the health of the cow has largely been held in the background. These two phases of the question are quite different, with widely varying methods of approach, but nevertheless the time has come when both should receive consideration for a full understanding of the subject.

The increasing use which milk and dairy products have enjoyed during the last few years as a result of the development of the newer knowledge of nutrition, renders it incumbent upon the dairy interests to appreciate more generally what full public confidence in the quality of the product is really worth in financial return. This confidence can not be obtained until the original source, namely, the producing animal, is placed in a position where her body is sound and the slogan, "Pure milk from healthy cows," is really made to mean something.

In a few places the economic question has been given foremost consideration by municipalities to the extent even of going into the milk business and developing a publicly owned and operated monopoly. An outstanding example of this kind is the city of Wellington, New Zealand, with a population of 125,000 inhabitants. Under the leadership of Councilor C. J. B. Norwood and Manager Henry A. Ward, this governmental novelty has been in operation for several years and has met with success in reducing the cost of milk distribution. Although the quality of the supply has been improved, bacterial standards have not been used, unless they have been very recently established. The quality of the incoming milk has been determined by the methylene blue reduction test applied at the receiving platform.

Budapest, Hungary, established a very remarkable municipal milk plant about 1893. It handled approximately 50 per cent of the milk supply for the 600,000 inhabitants of the city. The plant was directly supervised by the health officials of Budapest, and maintained a research laboratory. Pasteurized milk was prepared for the feeding of infants for one day in a series of bottles. This is known as the Saxlet method, after Professor Saxlet of the pediatrics department of the University of Vienna. At the time of its construction and for a number of years thereafter, this plant was considered the most ideal milk-handling establishment in Europe. Naturally the war and conditions following, caused it to suffer greatly, both in efficiency and the extensiveness of its operation.

The rapid development of the United Dairies, in London, called the milk trust, with a capital of $20,000,000 and 10,000 employees, resulted recently in a parliamentary investigation. The published report frees the company from all blame and gives it credit for a vast improvement in the milk business of Great Britain, which until recently has been conducted on such a low level, from both the sanitary and business standpoints, as to be almost a national disgrace.

The work on which this paper is written deals almost entirely with the sanitary side of the market milk problem.

OBJECTS TO BE ATTAINED.

The object of a successfully operated municipal milk inspection system is to make progress toward the ultimate goal. As no large community has yet reached the goal, progress is all we can look for. Too many costly abortive efforts have been made to step at one stride from inferiority to supposed perfection, with the invariable result of little or no progress. We must always realize that the inspecting departments stand between dwellers in urban communities on the one hand, having in too many cases little interest and less knowledge of conditions in the country. On the other hand are the dairy producers in rather large numbers who, above all agriculturists, have an exacting, long-drawn-out daily task to perform 365 days in the year, with a comparatively narrow margin of profit in return for the service rendered. Improvement, although justified and sound from public health and economic reasoning, can not be too suddenly carried out. The financial condition alone may be too great to overcome quickly. Time is required at best to get a large body of people to change from long-established practices and accept new ones.

Many dairy sections are saddled with bad economic practices, including barter in cattle, land leases, feed handling, and so forth, which tend seriously to retard progress. When pressure is applied too rapidly the dairymen, on account of various factors and because they exist in numbers, organize to resist, and when thoroughly aroused, will effectually retard improvement despite the almost unlimited police power of municipalities. All persons of long experience in the work who have been aggressive in bringing about improvements have seen this power demonstrated. To permit development of such a situation is a serious mistake for which there is each year less and less excuse. For this reason, one object of the work, and one of not the least importance, is cooperation with, and education of, the dairymen along progressive lines. Fortunately, in this country at the present time, in the farm bureau organization, dairy council work, breed associations and dairymen's associations, very potent agencies exist for accomplishing the purpose.

PERSONNEL OF THE STAFF.

In no single particular does the success or failure of the work depend in such great degree as on the personnel of the staff. Getting satisfactory men is an extremely difficult problem. Two almost insurmountable difficulties stand in the way. The first is the matter of salary. Good milk inspectors are notoriously underpaid in this country, and yet I venture to say without fear of contradiction that many men who are milk inspectors are getting more money than they are worth. City councils, and particularly their finance committees in control of the municipal purse strings, who have to do with a comparatively large body of employees, and fix salaries along uniform statutory lines, have not, up to the present time, recognized the qualifications necessary for such positions. The desired ability is possessed only by men who are worth more money than the salary that goes with the place, and therefore ideal men must be especially interested in the work or remain with it for other reasons than the actual money return received for the services rendered.

The other obstacle, after the appointment of men with proper qualifications, is securing for them the opportunity to work unhampered by political considerations. It requires character and singleness of purpose to crowd an obstinate dairyman whose brother or other close family relative is in a position of influence and accustomed to getting special privilege. One such man, if successful in his efforts, can greatly discourage an otherwise good inspector.

Appointments are usually made by competitive civil service examinations, a system which has many advantages, but one which renders it discouragingly difficult to remove incompetents. In examining men the civil service commission must make a generous allowance for experience and personality with a corresponding reduction in credit for the written examination. Many well-educated men, who can turn in an examination paper which grades high, are totally lacking in the essential qualifications of successful inspectors. Such inspectors must have a strong personality, good public contact ability, and an agricultural training. They should have a good knowledge of dairy husbandry, the construction of dairy buildings and drainage, with a practical knowledge of sanitation and the factors essential to keeping the bacterial content of milk at a minimum. It is not necessary that they should be veterinarians, but one or more men with veterinary training should be on the staff, if not in charge of it, on account of the fact that the health of animals must be more or less constantly passed upon.

LEGISLATION.

Proper legislation is necessary as a foundation on which to build the work. California has been particularly fortunate in this respect through the passage in 1915 of a State pure-milk law carrying a comprehensive grading system. It is an act to prevent the sale of impure and unwholesome milk, butter, ice cream, and other milk products; to declare ice cream a milk product; to grade milk; to provide rules and regulations therefor; and to empower cities, groups of cities, counties, and groups of counties, or cities and counties to establish inspection service, to provide for the enforcement of the act, to prescribe penalties for violation of the provisions thereof, and to make an appropriation therefor. Any city in the State desiring to avail itself of the provisions of this enabling law, makes application, for approval of its inspecting department, to the State department of agriculture, which administers the provisions of the law so far as the State is concerned. Those cities, such as Los Angeles, which had ample city ordinances and had been carrying on milk inspection for years with an adequate corps of full-time inspectors, were in an ideal position to avail themselves of its grading provisions and to proceed immediately to put them in force. The law provides for the following grades:

Certified milk under the rules and regulations of the certified milk commissions.

Guaranteed milk, raw or Pasteurized, the requirements for which are left to the local inspecting department.

Grade A raw milk, produced from cows that pass a tuberculin test applied free of charge by the veterinarians of the State bureau of animal industry. Such dairies must score 70 points on the detailed score card, and the milk must contain less than 100,000 bacteria per c. c. when delivered.

Grade A Pasteurized milk, from dairies scoring 60 points and containing less than 200,000 bacteria per c. c. before Pasteurization, and 15,000 afterwards when delivered.

Grade B Pasteurized milk, which shall contain less than 1,000,000 bacteria per c. c. before Pasteurization and 50,000 afterwards when delivered.

City ordinances covering the milk regulations must be carefully prepared in order to be proof against legal technicalities. The ordinances should provide for the permit system by which each distributor must apply for and receive a permit from the health department. To hold such permit he must keep the health office informed as to his source of supply, etc.

Matters which can not well be covered in the ordinances may be prepared in the form of rules of the health commissioner. These are then approved by the council, and this approval gives them the power of ordinances. In the city of New York, the board of health has the power to adopt rules and regulations governing the public health side of the milk business. A regulation on such matters adopted by the board and filed with the city clerk becomes a law with a severe penalty clause covering violations. This is an ideal situation for very large cities with experienced health officials. It can not be expected that delegation of such power would meet with the approval of the legislative bodies of many cities. Where health boards are constantly changing, the possibility that new men with little experience may gain control might result in some disadvantage with such a system.

COURT WORK.

Resort to court work should be had only after due thought and consideration. Measuring the success of the work by the number of complaints sworn out and convictions obtained is an exceedingly poor index. As far as possible, a general policy covering this work should be maintained to prevent special privilege from time to time gaining the upper hand. For example, all cases of added water or skimming should go to court. This is attempted by small operators only and recourse to the court seems to be the most effective way to stop the practice.

The maintaining of butterfat standards in restaurants is difficult on account of the constantly changing personnel of owners and employees in this business. Low butterfat samples from such places are usually evidence of carelessness in not stirring the milk so that part of the supply is served with too much fat and part with too little. A good policy in such cases is to allow samples not more than five-tenths per cent under the standard to go with a warning, and to take all cases below this to court. For example, if the butterfat standard is 3.5 per cent fat and samples are collected between 3 and 3.5 per cent, the restaurant owner is notified that the milk is not being properly handled. When samples are taken which test below 3 per cent fat, the owner is required to appear in court. This has proved effective in having milk properly handled from the time it is delivered to the restaurant until it is served on the table. Restaurant samples must be taken during meal hours.

Occasionally litigation is necessary to settle disputed problems of great importance to the industry. Such cases must be properly prepared so they may be tried on their merits and not thrown out of court on technicalities.

In general, court cases should be kept at a minimum, and the department should have the reputation of resorting to prosecution only when necessary, with carefully prepared cases which result in a high percentage of convictions.

METHODS.

In carrying on the work the staff must be divided into dairy inspectors, city milk plant inspectors, sample collectors covering wholesale samples to be Pasteurized, wagons, stores, and restaurants. A corps of 10 or 11 full-time inspectors, with a chief, and a well-equipped laboratory, is sufficient to handle properly the milk supply of a city of 600,000 people. With transportation furnished the men, the cost of the work will run from $25,000 to $30,000 per annum. This money should preferably come out of the general tax levy and no fees be charged to the dairy industry.

The dairy inspectors should have official headquarters in the dairy districts. The practice of some cities requiring inspectors to maintain residence in the corporate limits of the municipality seriously reduces efficiency. They may be brought into the office for meetings of the staff weekly, monthly, or quarterly, depending on the distance they have to travel. The dairies are scored on the detailed score card. Its value is not as great as was at one time considered, but it still remains the best method at hand of keeping on file information regarding the relative standing of all dairies and the work being done by the men. Its value is greatly enhanced by maintaining minimum standards below which the product is degraded or excluded from the city. Where minimum standards are enforced, printed rules for using the score card should be in the hands of each inspector. In case of argument these rules are shown to the dairyman and this prevents him from conceiving the idea that his low score is due to any personal feeling between him and the inspector. These rules are also of great assistance in having a corps of inspectors score uniformly.

The dairy inspectors are constantly informed by telephone or mail of the bacterial standing of the milk from dairies in their respective territories. Degrading is done when 80 per cent of the samples fail to meet the standard for the grade. No court work is necessary to maintain grades, because the reduced price a dairyman receives when degraded from A to B or B to butterfat automatically fines him from one to several hundred dollars a month in case the dairy is of any size. Reinstatement to grade is made only after five samples are taken, four of which are within the standard, and a period of two weeks is usually the shortest time in which this work can be carried out.

When requested, full assistance should be given on the ranch in ascertaining the trouble and how to overcome it. Considerable time on the part of the staff is sometimes spent in this work, but it is time well spent, because it is given where it is needed and does the most good. Information on incoming high-count milk is obtained from the health office laboratory, or attention is called to it from the counts regularly made by the milk-plant laboratories, free access to the records of which should always be available.

At the time grading was started in 1916, very valuable cooperation of some of the milk plants was secured in the payment of a sliding scale of premiums for milk, depending on quality, as ascertained by bacterial count and the sediment test. The premiums were arranged approximately as follows:

25 cents a hundred pounds for milk under	10,000.
15 cents a hundred pounds for milk under	50,000.
10 cents a hundred pounds for milk under	100,000.

All of the dairies were equipped with sterilizers, hooded milk pails, and water-cooling facilities. In southern California, the temperature of the water coming out of the ground is between 60° F. and 74° F. Natural ice is unknown, and to the majority of dairies the cost of artificial ice is prohibitive. For this reason, the temperature standard of milk coming into the city is 70° F. During warm weather delivery is made twice daily from the ranches. The sterilizer in most common use and which has been highly successful is described by C. L. Roadhouse in Circular 179 of the University of California Agricultural Experiment Station, "Factors of Importance in Producing Milk of Low Bacterial Count." Sterilization is by a wide margin the most important factor in reducing bacterial count. The equipping of dairies with sterilizers is much easier of accomplishment than getting them regularly used.

The premiums paid, together with the thorough education that had been carried on among the dairymen from the time the law was passed in the spring of 1915 and its going into effect on October 1, 1916, resulted in remarkable improvement in the bacterial count. In a very few months 90 per cent of the supply of milk to the city of Los Angeles to be Pasteurized met the requirements for grade A, and all bottled milk in the city has been grade A since that time.

An effort was made to put out bottled milk grade B for the grocery trade. There was great opposition to this by the trade, and this opposition, coupled with the enormous volume of grade A available and the competition of plants putting out only grade A, forced the grade B milk completely off the market. At present, only 7 of the 16 Pasteurizing plants handle two grades, and they distribute about 7,000 gallons of grade B in 3-gallon cans to the restaurant trade, a considerable part of which is of a quality to meet the requirements for grade A. The city consumes about 70,000 gallons of milk daily, of which 86 per cent is Pasteurized.

CONTINUOUS MILK-SCORING CONTEST PERIODS.

The organization of continuous milk-scoring contests is a very important aid to a health department properly organized to successfully carry out the work involved. The milk score card was originally developed by C. B. Lane, in 1906, and was for many years used in scoring milk at fairs. It is well-known that in these contests the samples presented had been produced under special conditions, and in no way represented the daily quality of the milk placed on the market by the various exhibitors. It was from this beginning, however, that the Dairy Division of the United States Bureau of Animal Industry developed the idea that the milk score card could be made of great service if it could be used to record the actual quality of the milk delivered in any particular community. From this there evolved a means of cooperation between the Dairy Division and municipal health departments, by which continuous milk-scoring contest periods were established, covering all the distributors of milk in the cities carrying on the work. J. E. Dorman, in charge of the western office of the Dairy Division, with headquarters at Salt Lake City, deserves credit for the installation of this work, and F. H. Bothell, formerly market milk specialist with the bureau, for the growth and development of the system in the coast cities. The details of these contests are fully described in United States Department of Agriculture Circular 53, entitled " Milk and Cream Contests," by Ernest Kelly and George B. Taylor.

To carry on the work successfully, the health department must be organized to collect at least two retail samples monthly from all distributors, and more from the larger ones. The samples are examined for bacterial count, butterfat, and solids not fat, and the results recorded in a card-index system. When the work is started all milk dealers should be notified. At the end of the first contest they should be placed in their proper standing, and a copy sent to all distributors, but otherwise no publicity should be given. This gives an opportunity for all interested to become thoroughly acquainted with the work. A new contest period starts immediately, and thereafter the results are given wide publicity in the newspapers. The daily papers do not always desire to accept such material, but their cooperation is so essential that all legitimate means must be used to have the copy accepted for publication. Information must be protected and copies go to all newspapers at the same time. Either the afternoon or morning papers will then get first publication, but this can be alternated.

When the contest period is to close, which may be at the end of three, four, or six months intervals, a representative of the Dairy

Division of the United States Bureau of Animal Industry, and one from the State agricultural college, are called upon to act in the rôle of judges. They are from far away, have official standing, and are recognized to be disinterested in local questions. The work of the inspecting department is concentrated upon getting to the health office laboratory one duplicate sample from every distributor, and more from the larger ones, in two or three days. These samples are taken from the wagons on the street, or in special cases, when wagons can not be found, from the distributors' ice boxes as the milk is ready to go out. They are examined by the visiting judges and scored for flavor, odor, visible dirt, acidity, and bottle and cap. The bacterial count, fat, and solids not fat are averaged with all the other samples taken during the contest period before being given a rating. The bacterial counts are numerically rated according to Dr. Charles E. North's curve. The average numerical rating obtained is referred back to the curve for count, and this is rated on the score card, according to directions printed on the back thereof. The curve is used because it works out more fairly than arithmetical averages.

When all of the score cards are made out they are divided into classes and published. A copy of the score card is mailed to each distributor. This requires a great amount of clerical work in the final tabulation, but after it is properly organized it can be carried out in a routine manner. With this system competition among the distributors becomes keen because the wide publicity given makes first place of real commercial value. Information on all the dairies is placed before the public, based on 100 points for perfect, in such a way as to be readily understood. The result is based on the quality of the milk extending over a long period, as it is actually delivered. No charge of unfairness can be substantiated, and the efforts of all are honestly directed toward getting a high score. Remarkable results have been secured by this system in a number of coast cities, particularly Seattle, Tacoma, and Portland, all of these cities not having had the advantages of a State law covering grading.

Dr. D. W. Mack, for many years in charge of the milk inspection service of the city of Portland, states: "I claim our contest work has done more in cleaning up our milk supply than all of our inspection work." With this system, the 100,000 bacteria per cc. allowed for grade A raw milk in California is much higher than necessary. Only about 9 per cent of the Los Angeles supply is of this grade, but a very high percentage of it will regularly run under 10,000, and samples approximating or above the maximum are extremely rare.

During the past seven years I have known of several instances where large city milk plants have been able to improve greatly the quality of their supply by the employment of a man trained in dairy bacteriology, the installation of a laboratory, and the payment of a sliding scale bonus for quality, determined largely by bacterial count. The milk bacteriologist is of great value in getting efficient Pasteurization and sterilization inside the plant. He will also have some time to visit dairies, the milk from which is running high in bacteria. A proper type of men for this work is so valuable to city milk plants that it is hard to realize why so many distributors operate without such assistance.

I would also like to call attention to the importance, in getting results in health work in municipalities, of a definite policy carried out over many years. Mediocre results, or gain and loss of ground, occur in many places on account of constant changing of personnel, with no definite policy. Dr. L. M. Powers, health commissioner of Los Angeles, has been in charge of the work of the health office for 28 years, and to his long tenure, ability, and vision are due the establishment of fundamental principles which have been developed and built upon gradually but surely. The many ramifications of the health office work render it impossible for the executive officer to attempt to administer the details in all branches with success. He must delegate authority to subordinates in charge of the various branches and hold them responsible for results obtained. This is difficult for many politically minded health officers to do, and it soon results in their becoming surrounded by a group of men lacking force and initiative, and the progress of the work suffers as a consequence.

CONCLUSIONS.

The essential factors in developing the sanitary side of a municipal milk supply are:

1. A corps of full-time inspectors sufficient to handle the work.
2. A well-equipped health office laboratory, and laboratories in the milk plants.
3. A bonus system of payment to producers for quality.
4. Equipment of all dairies with sterilizers and having them regularly used.
5. A grading system.
6. The installation of continuous milk-scoring contest periods.

Chairman **Weld**. Is there any one here who desires to ask Doctor Hart a question?

Doctor **Burri** (Switzerland). Does not the climatic condition have a great deal to do with keeping the count down? For instance, in California your cattle are out in the open the year round, whereas in colder countries they are kept in the barn part of the time. Is not the bacterial count less when the cows are in the fresh air all the time?

Doctor **Hart**. Not necessarily.

Chairman **Weld**. Dr. C. D. Pearce, chief of the bureau of dairy development, and chief veterinarian of the Borden Co., will discuss "Methods employed within the industry to improve the quality of milk." I take great pleasure in introducing to you Doctor Pearce. [Applause.]

METHODS EMPLOYED WITHIN THE INDUSTRY TO IMPROVE THE QUALITY OF MILK.

Charles D. Pearce, D. V. M., chief, bureau of dairy development, The Borden Co., New York City.

The agricultural and health departments of our Nation, State, and community have, for years, been endeavoring to correlate the economic problems of the production of milk with the necessary healthfulness, cleanliness, and keeping qualities of the finished product. Big things have already been accomplished, but greater achievements are on the horizon for the individual or company who can utilize the work that is being done and has been done, so that the dairyman can obtain a fair return for his work and investment and at the same time, be educated to produce a better product.

For many years the conditions on the farms have been depicted in writing by means of a score card. This is not a perfect system, but it serves a useful purpose and makes comparisons possible. It does not, however, measure the quality of the product. A man may have a fine equipment but produce a poor quality of milk. The reverse is likewise true, that good milk can be produced with poor equipment. Here is where the laboratory plays its part and determines by means of bacterial counts the quality of milk each dairyman delivers.

No system of dairy or laboratory control is of much use unless there is an organization to apply and follow up this work. We believe a veterinarian or a man with public-health training, with country experience, should be in charge. Such a man is equipped to select and train as dairy inspectors men of elementary education who will carry out the detail work of dairy control. Local veterinarians may be employed to look after the health of the cattle, but we believe in having our own force, making our men a part of the organization, and having them take charge of the inspection work in their respective territories.

This body of men not only copes with any outbreak of disease, but becomes, if efficient, the educational medium in the dairy field, setting forth the best practices of sanitation, building construction, breeding, feeding, etc. The possibilities of this field are unlimited.

One other man plays a very important rôle, the receiving inspector, who links the factory with the field work. It is necessary for him to know milk in all its phases. He passes upon all milk received. If badly tainted or sour milk is passed by him, it may contaminate the output from that factory, whether it be manufactured or used for fluid milk distribution. As other controls come into use, the tendency is to relax upon the qualifications for this position, with the result that our old-time receiving inspector is slowly becoming extinct.

The results of dairy development are best seen whenever a new territory is opened. By attacking the worst condition first, praising the dairyman where praise is due, sympathizing with him in his losses, helping him to work out his problems, and supplying him with a steady market throughout the year, the territory slowly but surely begins to improve. The cows are groomed and free from hanging manure. The stables are whitewashed. The manure is stored where the cattle can not reach it. The yards are graded and drained. New stables, milk houses, and cement floors begin to appear. The utensils are properly constructed and well cared for. The milk is properly cooled and delivered. In fact, the whole district takes on new life, and the farms themselves increase in value. The proof that the milk supply has improved lies in the fact that our laboratories show a higher score for the dairies from a bacterial standpoint, and from 50 per cent to 75 per cent less milk has to be rejected for various causes. The inspection force builds up the territory while the laboratory determines how efficiently the dairymen use their equipment.

For the past few years a part of our supply has been bought, and a premium paid for a low bacterial content. Samples of each dairyman's milk are taken twice a week, and the bacteria determined by means of the plate method. One of these samples is taken from the morning's and the other from the night's milk. The average of these two counts gives the count for the week. A dairyman producing milk of a bacterial count below 10,000 per cubic centimeter receives the flat price plus a premium of 40 cents a hundred. A dairyman producing milk of a bacterial count of from 10,000 to 25,000 per cubic centimeter receives the flat price plus a premium of 25 cents a hundred. All dairymen producing milk above 25,000 bacteria per cubic centimeter receive the flat price. The flat price is based on a 3 per cent butterfat content. For each one-tenth of a per cent above this figure an additional premium of 4 cents is paid. The butterfat content is determined by the Babcock test.

A card is sent out every week to each dairyman, stating thereon the bacterial count of his milk. This allows him to check over his methods and to improve his supply before the next count is taken. A list of bacterial findings is given to the dairy inspector, who, in turn, visits each dairyman having a high bacterial count. He also investigates all milk rejected for any cause. This follow-up work is for the purpose of locating and correcting trouble.

This grade of milk is designated as "grade A Pasteurized" by the department of health of New York City, and conforms to their rules and regulations relative to this grade. They permit but one grade of milk to be handled at a shipping station. In addition to our own inspection force, we receive the benefit from an inspection every three months by a representative of the department of health, who visits and makes out a score card for each dairyman producing this grade of milk. Our veterinarians, however, examine the cattle every six months in order to control more closely these grade A supplies, although only one examination is called for by the department of health code.

Inasmuch as milk for the first hour or two does not reflect a marked development of bacteria, warm morning's milk is accepted up to 8 o'clock in the morning. This allows all the stress for sufficient cooling to be placed on the night's milk, which must be cooled immediately after milking to at least 50° F., and delivery must be made at this temperature or below. It is our belief that the cooling should be done in cans surrounded by ice water and not by the use of an aerator.

In locating a grade A shipping station, we pick one of our stations showing the best sanitation, equipment, and cooling facilities. Our inspection force, headed by the veterinarian, makes a canvass of the territory, and brings the dairies into such condition that they will pass a department of health inspection. They also see that all certificates of health for the cattle are filed. Upon application, a department of health representative passes upon the factory and the dairies as a satisfactory supply for this grade of milk. Whenever a dairyman can not live up to the requirements, he is dropped until such time as he can comply. If a factory or a dairyman is embargoed by a department of health inspector, such dairyman or factory can not be reinstated until passed upon by the department of health.

The buying of milk on this basis has worked out very satisfactorily as is evidenced by the following:

	Dairymen producing milk containing less than 10,000 bacteria per cubic centimeter.	Dairymen producing milk containing from 10,000 to 25,000 bacteria per cubic centimeter.	Dairymen producing milk containing more than 25,000 bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*
1919	53	26	21
1922	70	20	10

This milk came from 23 shipping stations, representing 1,400 dairies. In 1922, there were produced 150,000,000 pounds of grade A Pasteurized milk. In the same year, the sum of $427,000 was paid in premiums.

Prior to the installation of premium payments for a low bacterial count, the grade A Pasteurized supply was bought on a flat price plus a premium based on a barn score. This did not improve our quality, as we had no check on the product. With the adoption of the present system, results were immediate. The dairy conditions were not only improved but the city consumer recognized an improved quality as shown by increased sales. The total daily consumption of grade A milk is now about 300,000 quarts in New York City proper, exclusive of the New Jersey suburbs. About 19 per cent of our supply is produced as grade A Pasteurized.

Other figures are available, which are of interest as they show how the dairymen reacted to the buying of milk on a bacterial basis. This work was started in July, 1917, at two factories where the milk prior to that time had been purchased as grade A Pasteurized on a barn-scoring basis. Two months later, in September, the counts are given for comparison, the milk having been bought in the meantime on a bacterial basis.

	Dairymen producing milk with 25,000 bacteria or below per cubic centimeter.	Dairymen producing milk from 25,000 to 100,000 bacteria per cubic centimeter.	Dairymen producing milk from 100,000 to 500,000 bacteria per cubic centimeter.	Dairymen producing milk above 500,000 bacteria per cubic centimeter.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
July, 1917	7	20	60	13
September, 1917	75	15	10	0

We will now discuss the control of the milk bought without any premium paid for a low bacterial content, which constitutes the bulk of the milk handled by us. This milk is bought on a butterfat basis, the same as the grade A Pasteurized, but without any other premium. In the New York City market, this is known as "grade B Pasteurized," and it conforms to the rules and regulations of the Department of Health of New York City relative to this grade. Our supplies outside of this market are not graded and the same control is exercised over this milk as is given the grade B Pasteurized.

The maintenance of a supply of raw mixed milk is dependent upon our ability to identify the dairymen who, because of faulty methods of cooling or caring for their milk, or laxness in the care of their milking utensils, persistently produce milk containing a high bacterial content. This milk in turn contaminates all milk with which it is mixed in the storage vats, and at times may endanger the whole supply for either manufacturing purposes or for fluid milk distribution. The Breed method has been very useful in identifying these high count dairies, and in enabling us to inform the dairyman of the kind of milk he is producing and the purchaser of the kind he is buying.

The samples for making the Breed examination are taken every two weeks from a well-stirred can of milk from each dairyman. These samples are caught in sterile vials as the milk is dumped. The vials are placed in a special rack surrounded by ice water and held at a low temperature until the smears are made. By means of a pipette, 0.01 of a cubic centimeter is transferred to a glass slide and smeared over a square centimeter of space. As a means of identification, the number of the dairy is placed above each smear. For convenience, 12 smears are placed on each slide. The smearing is aided by the use of a guide, which marks out the square centimeters, and which is used beneath the glass slide containing the smears. These smears are allowed to dry slowly and are then stained and read in the laboratory. The field of the microscope is calibrated to cover $\frac{1}{300,000}$ of a square centimeter. Fifteen fields are generally counted, counting each clump or isolated bacterium as one. The bacteria are estimated and the milk graded as follows:

0 to 5 clumps or isolated bacteria in 15 fields denote *good* milk or less than 100,000 bacteria per cubic centimeter.

6 to 25 clumps or isolated bacteria in 15 fields denote *fair* milk, or a count from 100,000 to 500,000 per cubic centimeter.

Over 25 clumps or isolated bacteria in 15 fields denote *poor* milk with a bacterial content of over 500,000 per cubic centimeter, and is considered unsatisfactory and a source of danger on account of its contaminating influence on the *good* and *fair* dairies when mixed in the storage vats.

As a rule these glass slides are mailed in a special mailing container, to a central laboratory, where the smears are read and the results returned to the factory. At our larger factories, where laboratories are maintained, the smears are read in the laboratories, and a few check smears are forwarded to the city laboratory, in order that the work done by the local Breed operator may be checked, which insures accuracy. A blank is used to report the bacterial findings. The dairies are listed according to number, and the class into which the milk is placed is indicated by "G" for good, "F" for fair, and "P" for poor. The dairies marked "poor" are the only ones with the actual count given. A copy of the report is sent to each factory. The laboratory makes the readings and the bureau of dairy development investigates the dairies marked "poor."

A special form is used by the dairy inspector on which to report his findings regarding the cause for the high bacterial count. This same form is also used to follow up all milk rejected for any cause.

In case milk is rejected, the receiving inspector fills out this report in duplicate, showing the dairyman's name, the number of cans returned, and the cause for the rejection. One copy is placed on file and the dairy inspector receives the other. He, in turn, visits the dairy and makes a report on the conditions found. Where this form is used for checking high bacterial counts, the dairyman's name appears together with the date of the bacterial report. The dairy inspector visits the farm and reports the cause for the high count. To render this system valuable, these high count dairies, or dairies from which milk has been rejected, should be visited as soon as possible after the report has been received. The next bacterial count taken determines whether our inspector has been successful in his efforts. In this way we are able to follow the activities of the dairy inspector. At the same time, all questionable milk is checked up, demonstrating to the dairyman that we are interested in his product, and wish to help him identify and overcome his difficulty. The result is that the quality is improved and the quantity of milk rejected is reduced to a minimum.

In case a dairyman continues to produce milk containing an excessively high bacterial content, it is necessary at times to take a sample of his milk every day until the cause is found and corrected. In exceptional cases, it is necessary to do this in order to convince a dairyman that the laboratory can determine his methods of caring for the milk and the utensils on the farm by the bacterial count. This is especially true where a milking machine is used, as the majority of dairymen who use these devices simply rinse them with cold water instead of thoroughly cleansing them after each milking. A milk of poor quality results.

It has been found that high bacterial counts develop in the udders of cows with more frequency than is generally believed. In order to overcome this, it has become a general practice on the part of our dairy inspectors to use garget cups. Our veterinarians, when making physical examinations, use these cups to detect diseased udders.

A garget cup consists of two parts with a fine wire-mesh strainer between. Almost without exception where garget is present the first few streams of milk will show a few clots of thick milk when milked into one of these garget cups. A few streams of milk from each quarter are milked upon this strainer; any cows showing any thick milk are located and the milk eliminated until the cows recover or are disposed of, as the case may demand. At times this procedure is not sufficient. Samples are then taken of the milk of each cow in the dairy, and the laboratory makes an analysis in order to locate any trouble. This is especially necessary when no apparent cause can be found for a high bacterial count, or where the Breed smears continually contain evidence of inflammation or infection, indicated by long chains of streptococci or leucocytes. The laboratory's findings are generally conclusive, and with the elimination of the milk from two to three cows, the trouble ceases.

The intelligent use of the sediment test has been of benefit in eliminating visible sediment from the milk received at the station. The cotton containing the sediment can be shown to the dairyman and it is something he can see and understand. The correction, however, is not in better straining, but in finding and removing the cause.

The clipping and grooming of cows, wiping the udders and flanks with a clean, damp cloth, the use of a small-mouth milk pail, the draining of yards, and the racking of cans and utensils away from dusty highways, are all factors in obtaining better sediment tests. In a great many cases there does not seem to be much connection between sediment and high bacterial counts, although there is none of us who cares to use milk containing very much visible sediment.

The effectiveness of the dairy control work is measured by the quality of the finished product. At times losses occur in manufactured goods that are traceable directly to the raw product. Everything else being equal, the better the raw product the better will be the manufactured article. In our city supply of fluid milk, however, we have a very accurate record of the number of cans of sour milk and cream received. In comparing the year 1919, when the Breed control was established in our factories, with the year 1922, the results are interesting. We find during 1922, 95 per cent less sour milk, 87 per cent less sour cream, 97 per cent less sour plain condensed milk, and 73 per cent less bitter cream than in 1919. Undoubtedly these results are not entirely due to the dairy control, but this organization is certainly a vital factor. Price conditions are another very important consideration in building up a dairy field. When prices are good much can be accomplished, but when the reverse is true the work of dairy development is slower, and more difficulty is experienced in obtaining improvements.

To summarize: The means employed within the industry to improve the quality of the milk render necessary the development of an organization to carry out this work. To obtain the greatest efficiency the veterinarians, laboratory workers, dairy and receiving inspectors all should work together. Any one part of this organization is not sufficient by itself. The veterinarian has charge of the inspection work, and makes a physical examination of the cattle, eliminating any cows whose milk would be a menace to the supply. The laboratory determines the quality of the milk and furnishes the field men with information as to the dairymen who are producing a poor quality. The field inspectors visit the farms showing the low-grade milk, and through their efforts the equipment and methods are improved.

Some of our milk is bought and a premium paid for a low bacterial content to improve the quality. This method has worked out very satisfactorily, as has been evidenced by an increased number of dairymen who receive premiums, and an increased consumption. In our other supplies, where no premium is paid for a low bacterial count, the Breed method is used in determining the quality with excellent results. In tracing high bacterial counts, especially during the cold weather, we have found the cause in the udders of cows more frequently than is generally believed. The garget cup and the laboratory are very useful in locating these cases. The sediment tester has been helpful in eliminating sediment, although sediment does not necessarily mean a high bacterial content. An enormous reduction in the number of cans of unsalable products received in our New York City fluid milk market is shown by comparing the years 1919 with 1922, since the present method of dairy control has been in effect.

The development of successful dairy control has not been spontaneous, but represents years of experience. Although it has fluctuated from time to time, because of upheavals in the milk industry, the underlying principles have been correct. In years past stress was placed on the sanitary conditions and the building up of dairy fields. During the past few years this part has not been lost sight of, and the work has been augmented by laboratory controls which have been instrumental in showing the quality of the milk as received.

Clean milk produced by clean healthy cows, which has good food value, which has been properly refrigerated, and which has a low bacterial content, fulfills our requirements as to quality. Our ideal has perhaps never been reached, but we are closer to it to-day than ever before.

Mr. M. A. O'Callaghan (dairy expert of the commonwealth, Melbourne, Australia). In dealing with the bacterial count your paper did not state whether or not there was a classification. That is one question. Second, how long after the milk is drawn from the cows are the smears made?

Doctor Pearce. Milk is delivered once a day and consists of the morning's and night's milk. A sample is taken from an individual can of well-stirred milk from each dairyman's delivery. These samples are placed in ice water and refrigerated until the smears are made. The smears are made as soon as all samples are collected, which is generally in the afternoon.

Mr. O. W. Strodthoff (creamery manager, Los Angeles, Calif.). Without the use of an aerator, how long does it take to cool to the center of the can?

Doctor Pearce. In a series of tests conducted a few years ago it took from 30 to 40 minutes under ideal conditions.

Mr. Strodthoff. What objection do you have to the use of an aerator?

Dr. Pearce. All dairymen have not sufficient hot water or steam to sterilize an aerator. If this utensil is not properly sterilized it does more harm than good.

Chairman Weld. The next paper is by Mr. R. W. Balderston, secretary of the Philadelphia Interstate Dairy Council, and the subject is "Motion pictures and dairy education."

MOTION PICTURES AND DAIRY EDUCATION.

Robert W. Balderston, secretary, Philadelphia Interstate Dairy Council, Philadelphia, Pa.

There are about 15,000 theaters and 256,000 schools in the United States, yet about 16,000,000 persons see the movies daily, while the school attendance is only about 10,000,000. Considering education in the broad sense, that of informing and influencing public thought, the moving picture is more widely used and is a more effective agency of education to-day than is the school.

John James Tigert, now United States Commissioner of Education, has said: "A picture is a universal film which everybody understands, whatever his language may be. I believe that in Americanization, one of the greatest educational problems we have, the motion picture is going to be one of the most useful agencies. Take a man who was born in some other country, with different ideals from ours. You can teach him history out of a book, but still he will not understand America; but show him the great West, show him Jamestown, Gettysburg, Independence Hall, and tell him their stories, and he will begin to understand."

Colonel Owsley, late commander of the American Legion, in describing the systematic use of motion pictures as a means of educating our men in better citizenship, said that he could interest more than 50 per cent of his men with moving pictures. When he was asked his opinion as to the power of motion pictures to mold public opinion, he said: "I think it is far-reaching and tremendous. I know of no one other force in America at this time that has so great a power to influence public opinion. I base this statement upon first-hand observation, and upon information furnished me after a careful investigation of every city in the Nation, before we went into the film business. I became convinced that the American Legion could reach more people through the movies than through any other agency, and we have spent sums of money on motion pictures which otherwise we would have spent through our speakers' bureau."

Thos. A. Edison, in testifying, confessed that when motion pictures were perfected, he was indifferent to the amusement possibilities of the movies. What interested him were the educational possibilities, and he devoted himself to this branch of the subject, while others developed the amusement side. He then tried to interest the school boards in moving pictures, but the big boards of education were indifferent to the idea, and the inventor says that the interests publishing books antagonized it.

The motion picture is successfully employed in dairy education in a number of ways. Several agencies are producing good films. Their distribution is very wide, although somewhat unorganized and disjointed.

The United States Department of Agriculture has a complete motion-picture bureau in its Division of Publications. It has recently completed an especially devised building, devoted to the production and distribution of motion pictures. This distribution is general through the agricultural extension service of the several States. A large number of its films are devoted to dairy topics. Many State colleges and State libraries have educational film departments, and in some States they have produced dairy films of educational value. The breed associations and other dairy organizations, and the feed and machinery companies have been active in this work.

The National Dairy Council is now regularly producing films on a wide range of dairy themes, and these are systematically distributed by district councils, as well as by the National Dairy Council headquarters. These dairy films have been shown to widely different groups of persons, as follows:

(1) Dairy farmers at country meetings see films on such subjects as better feeding, better breeding, clean milk production, cow-testing associations, and cooperative marketing.

(2) Manufacturers are shown better methods.

(3) College and high-school students are helped in the discussion of every important dairy question.

(4) City consumers and city children learn how milk is produced and its importance in nutrition.

(5) Theater audiences see entertaining films with a nutrition moral.

A number of improvements in the machinery for projection as well as the film itself have made possible a wider use of dairy films in educational work during the past two years. Almost all of the fire risk is eliminated by the use of the so-called safety film and any one of a number of standard portable projectors using incandescent lamps. The brilliancy of the picture shown by such projectors has been increased by the use of a generator for electricity attachable to any automobile.

A number of limiting factors prevent much wider use of motion pictures in the dairy education field:

(1) The regular quick-burning film is not recommended for use without a fire-proof booth. This seriously restricts the number of films that are available to the user of a portable machine, as at present an overwhelming majority of all films are printed only on this inflammable stock. Also, slow-burning films at present are produced in a variety of widths without uniformity of sprocket holes. It is hoped that a concerted effort will be made by all interested agencies to have all films, certainly all educational films, printed only on the slow-burning or safety standard width (noninflammable) stock.

(2) State laws with reference to educational motion-picture exhibitions need immediate standardization, and in many cases intelligent amendment. The hand of a lobby of the commercial motion-picture interests fearing competition has been felt in many States, and some laws might indicate that it had helped dictate the policies that have prevailed. In many States, particularly in New England, the only film that can be used without a booth is a narrow-gauge one in which no motion pictures are produced except when specially ordered. New England, therefore, can not tap any large reservoir of desirable films. In some cities it is necessary to use an asbestos booth, even with noninflammable films, and safety fire-proof portable projectors. The Philadelphia Interstate Dairy Council operates in four States. There is no uniformity of regulation in the four States, or in the cities within them.

It is unnecessary to describe the motion pictures now available. Everyone interested can see them for himself. The theme and the composition of many of them compare favorably with those shown in any commercial theater. I trust everyone has had an opportunity of seeing them.

As a part of an educational meeting, either city or country, the motion picture has a distinct place. It is accurate and graphic in description, and in it facts are technically detailed and entertainingly presented. Appealing to the eye, the sense through which we are told we receive 87 per cent of our impressions, it most readily conveys the intended message, even to the dull and the uneducated.

Flexibility is given to many programs by the use of well-chosen films, which would not be possible to accomplish if the program were dependent wholly on addresses by qualified speakers. Movements, such as that of the hand in milking or in operating machines, can be thoroughly analyzed and explained by retarding the normal speed in reproduction in the motion pictures.

With a well-chosen story as a background, many nutrition and health themes, such as the value of milk to athletes and the care of milk in the home, can be told to immense groups, in the city moving-picture theaters. One United States Department of Agriculture picture, "Out of the Shadows," depicts the importance of bovine tuberculosis eradication so vividly that at a country meeting in Pennsylvania one night, a whole neighborhood was impressed with the danger of this disease and the importance of its elimination. One farmer walked into the farm bureau office the next morning, and said: "I wasn't ready before, but that picture last night was enough. When can I get my cows tested?"

The dairy council early recognized the value of motion pictures and uses them regularly in several fields.

The Philadelphia Interstate Dairy Council has produced two films, one of two reels (a half hour), and one of three reels (three-quarters of an hour), to use in quality control work among milk producers and milk handlers. We consider this our most important field for motion pictures. These pictures have attracted large audiences in blacksmith shops, garages, country schoolhouses, grange halls, and churches. Many successful summer showings have been given in the open air. Comparative records show that the farmers and others present take home the lessons of these films, and in a very large measure apply them individually.

(3) The National Dairy Council has a larger group of films, some from the United States Department of Agriculture, some from other sources, and several of its own production, that are used regularly as one of the features of nutrition and civics meetings in our great consuming centers. These meetings are held in schoolhouses, community houses, churches, Young Men's Christian Association and Young Women's Christian Association halls, etc. Films are regularly borrowed by school departments to aid in the teaching of such topics as health, civics, and commercial geography.

(4) Carefully selected films are being very successfully distributed by the dairy councils in the theaters. The National Dairy Council has purchased some of these from other agencies, and two have been produced in Philadelphia by the Philadelphia Interstate Dairy Council. The first one of its own production, "Highland Lassie," was shown to 1,000,000 people in Philadelphia, Trenton, Camden, Chester, and in the seashore towns last winter. The last one released, "Shadows," is now fairly launched on a winter's campaign in a number of cities. (All dairy council films are being shown at the National Dairy Council booth on the grounds during the National Dairy Show.)

To avoid duplication of effort and to insure a uniform high standard of production, a national production committee should be established, or some existing organization, such as the National Dairy Council, should be designated to coordinate the production of dairy films. Many times lately it has been found that two different agencies had, unknown to each other, been working on the same theme, thus producing two pictures where one would have served the purpose.

There are many films, needed now in a national way, which are not produced because no one agency has sufficient distribution in itself to absorb the heavy cost of production; also the production of films is a highly specialized calling and needs special experience and training.

One hesitates, in so short a paper, to moralize on the value of the motion picture as a medium to be used in dairy education. That principle seems so self-evident as to be almost axiomatic. I have tried briefly to point out some of the ways that films are now successfully used, and to characterize some of the types of pictures available. I hope that I have not overemphasized the difficulties involved at the present time. By motion pictures, new developments in dairying are graphically portrayed to our own dairy interests and by them, also, we are keeping before the public those fundamental factors that make the dairy industry so absolutely essential to human welfare.

Chairman WELD. We all know the value of the research work that has been carried on. Mr. S. H. Ayers will now present a paper on the subject "What constitutes efficiency in Pasteurization." Mr. Ayers is now the research director, Glass Container Association. I take pleasure in introducing Mr. Ayers.

WHAT CONSTITUTES EFFICIENCY IN PASTEURIZATION.

S. HENRY AYERS, research laboratories, Dairy Division, United States Department of Agriculture.

Before undertaking to discuss efficiency in Pasteurization, we must have a clear understanding of the object of the process.

Pasteurization as applied to milk for direct consumption was conceived as a public health measure. Its object was and still is to make milk safe for consumption by the destruction of any disease germs with which it may have become contaminated.

Milk may of course be heated properly and then contaminated after Pasteurizing, so the efficiency of Pasteurization must be based upon the success in carrying out a number of steps which really make up the process. Successful operation must be first viewed from the angle of the object of the process and not from a financial viewpoint.

I do not mean to imply that milk-plant economics are not to be taken into consideration in milk-plant operation, for these have much to do with successful operation. The thought I wish to convey is that the efficiency of Pasteurization, as a public health measure, is of primary importance, both to health authorities and milk dealers, and, as discussed in this paper, applies to the successful operation of the process as a means of making milk safe.

THE PASTEURIZING PROCESS.

For the process to be efficient it must be based on correct principles which, briefly outlined, are as follows:

1. Heat all the milk to 145° F., and hold all the milk for 30 minutes.
2. Handle milk during cooling, bottling, storage and delivery, so that no contamination by pathogenic organisms can occur.

Proper Pasteurization comprises two distinct phases. The first is concerned with heating milk so as to destroy any pathogenic organisms in the raw milk, and the second has to do with proper handling to prevent reinfection with disease germs.

BACTERIA AS A MEASURE OF EFFICIENCY.

Bacteria counts and special tests are used as an indication of the efficiency of Pasteurization, so that it seems advisable to discuss rather fully the application and limitations of these tests.

In discussing bacteria counts I am considering the official count made on standard agar incubated for 48 hours at 37° C. It must be stated, however, that neither this medium nor temperature gives the full value which may be obtained by plating methods. If we are to make progress along the line of bacteria control we must have qualitative as well as quantitative results. The use of milk powder agar, devised in our laboratories, which gives qualitative results, seems to be a step in the right direction. There is, however, a decided sentiment against the use of this medium because it gives higher counts than standard agar, and health officials feel that its use would necessitate changing bacteria standards. But if progress is to be made the view of these officials must change with new developments.

It should be kept in mind that the discussions of bacteria counts in this paper are confined to the present official methods.

RAW MILK.

If there were quick means for detecting pathogenic organisms in milk, then bacteria tests would provide a direct and simple measure of efficiency, but, unfortunately, such methods are not available. It therefore becomes necessary to rely upon bacteria counts, properly made and interpreted, as a general index of conditions or upon tests for specific types of bacteria. A low count, either in raw or Pasteurized milk, does not guarantee the absence of disease germs. The epidemic of typhoid fever at Fort McPherson, Ga., traced to a raw-milk supply with a bacteria count which averaged from 2,000 to 5,000 per cubic centimeter offers striking proof of this fact. However, bacteria counts in raw milk bear a somewhat direct relation to conditions of production and handling.

While a low count with raw milk does not guarantee freedom from disease germs, it does indicate care in production and handling, and with a lessening of contamination and increased care in handling, there must be a decreasing chance of infection with pathogenic organisms.

PASTEURIZED MILK.

The bacteria count of Pasteurized milk is more complicated when it comes to interpretation, and bears only a general relation to the count before Pasteurization. Generally speaking, a high-count raw milk will give a high-count Pasteurized milk, but there are so many complicating factors that this can not be observed as a strict rule.

The interpretation of a bacteria count of any milk, whether raw or Pasteurized, can at best only serve as a general index and should be used with this idea in mind. When made under definite conditions with a definite medium and the same methods, counts provide a picture of a combination of conditions with regard to milk which, if interpreted correctly, give an idea of any important changes in these conditions. Such information provided by routine tests should serve to point out unusual changes which require further investigation.

When used in this manner routine bacteria counts made by the laboratories of health departments and milk dealers are valuable, but it is nothing short of ridiculous to depend upon bacteria counts of Pasteurized milk as the only means of determining efficiency and as a measure of safe milk.

In order to interpret the count properly, consideration must be first given as to where and when the sample was taken. If the sample represents fresh Pasteurized milk, and is taken at the plant immediately after bottling, the count measures the numbers of bacteria which survive the heating process, together with any contamination through machinery and bottles. If taken from delivery wagons, the count will measure the same thing, but also, in addition, any growth which may have taken place.

When the counts are high in fresh-bottle Pasteurized milk, they may be due to contamination, to high-count raw milk, to an unusually high proportion of resistant types, or, in special cases, to growth of a thermophilic organism which will be discussed later.

In order to determine which of these causes is responsible, further investigation is required in which a series of samples are taken at each step in the process. The interpretation of the results of such a series is again complicated, because of the fact that there is no assurance that the samples represent the same milk at each step in the process. In some plants, it is, of course, possible to take samples in such a way that some of the same milk can be examined at various stages in Pasteurization. In other plants there is a continuous flow of milk, so varying in kinds and numbers of bacteria as to complicate seriously proper sampling. I am emphasizing some of these points so that there may be no false illusion that series samples on test runs can be analyzed and interpreted in a haphazard manner.

BACTERIA WHICH SURVIVE PASTEURIZATION.

It is impossible to interpret properly bacteria counts of Pasteurized milk or the results of special tests without a fundamental understanding of the bacteria which survive the process.

The bacteria flora of milk is extremely variable. Relatively speaking, it contains a few spore-forming bacteria which are resistant to Pasteurization. The majority of the bacteria are nonspore formers which were formerly thought to be destroyed by Pasteurization. Among these bacteria were included the lactic acid streptococci, which were believed to be destroyed.

Research work has shown, however, that there is a variable proportion of nonspore-forming bacteria which are not destroyed at the Pasteurizing temperature. Fortunately, the disease-producing bacteria are not included in this class, for they are readily destroyed. It is the presence of these heat-resistant bacteria which must be considered in the interpretation of bacteria counts of Pasteurized milk.

There appear to be two general classes of these resistant nonspore-forming bacteria: First, those which have a low majority thermal death point and only a few cells survive; and second, those which have a high majority thermal death point. When milk is properly Pasteurized at 145° F., for 30 minutes, bacteria of the first class do not survive in large enough number to influence the count, but those of the second class often are responsible for high counts. It is at once apparent that milk might be properly Pasteurized and handled, and yet have a high count due to these heat-resistant organisms. Occasional high counts are due to these types of bacteria, but since these organisms are not pathogenic, it is difficult to see how they affect the safety of a Pasteurized milk, yet bacteria counts alone would indicate a defect in the Pasteurizing process. An occasional high count caused by these resistant organisms is merely another example of how the bacteria count of Pasteurized milk is useful as a means of indicating some conditions out of the ordinary.

SPECIAL TESTS FOR EFFICIENCY.

Percentage reduction of bacteria by Pasteurization was formerly taken as an index of the efficiency of the process. Since the newer knowledge of the nonspore-forming bacteria with a majority thermal death point above the Pasteurizing temperature, the fallacy of such an index has been recognized. Generally speaking, about 99 per cent of the total bacteria are destroyed by Pasteurization at 145° F. for 30 minutes, yet samples of milk have been Pasteurized in this manner under controlled conditions in our laboratories, with a percentage reduction ranging as low as 82 per cent. This is due to the variable proportion of resistant nonspore-forming bacteria.

COLON TEST.

The colon test is sometimes used as an index of efficiency of the process and is of value provided it is properly used and its limitations understood.

Colon bacilli have a low majority thermal death point, but on account of the resistance of a few cells they may survive the Pasteurizing process. The colon test, therefore, as an index of the efficiency of the process of Pasteurization, is complicated by the ability of certain strains to survive a temperature of 145° F. for 30 minutes, and to develop rapidly when the Pasteurized milk is held under certain temperature conditions met during storage and delivery. Consequently, the presence of a few colon bacilli in Pasteurized milk under ordinary conditions, does not indicate that the milk was not properly heated.

The presence of a large number of colon bacilli, immediately after the heating process, indicates that the milk has not been heated to 145° F. for 30 minutes, and the test properly applied should be valuable in control work. Fermentation tubes can be used for making the test, but when gas formation is noted the presence of colon bacilli should be demonstrated by further tests. Often anaerobic spore-formers are encountered which survive Pasteurization and give the typical fermentation tube test. If the colon test is used, it should be applied to samples of the Pasteurized milk taken immediately after the process is completed.

PRESENCE OF STREPTOCOCCI.

There is a tendency on the part of some authorities to look upon the presence of streptococci in Pasteurized milk with suspicion. This situation has arisen because of the fact that streptococci are so often the cause of infections. But it must be borne in mind that there are more harmless than dangerous streptococci.

There have been extensive studies of pathogenic streptococci, and it has been found that they are destroyed by heating to 145° F. for 30 minutes. What has led to confusion is the lack of appreciation of the fact that there are heat-resistant species among the harmless streptococci.

There are two classes of streptococci which survive Pasteurization:

(1) Streptococci which have a low majority thermal death point, but among which a few cells are able to survive the Pasteurizing temperature. This ability of a few bacteria to survive may be due to certain resistant characteristics peculiar to them, or it may be caused by some protective influence in the milk.

(2) Streptococci which have a high thermal death point, and which, when such is the case, survive because this point is above the temperature of Pasteurization. This ability to resist destruction by heating is a permanent characteristic of certain strains.

These streptococci which have a thermal death point above the Pasteurizing temperature play an important part in the occasional high counts found in Pasteurized milk.

Among the streptococci of class 1 is the milk-souring organism, *Streptococcus lactis*, while those of class 2 seem to be closely related. These resistant streptococci are not only harmless but valuable, in so far as they cause the souring of Pasteurized milk and restrict undesirable decomposition by peptonizing bacteria.

Without a clear understanding of these facts, false interpretations may be given to the presence of streptococci in Pasteurized milk; and in view of the facts, it is not clear that a test for streptococci has any significance as a measure of the efficiency of Pasteurization unless it be to explain occasional high counts.

SPECIAL BACTERIA PROBLEMS.

When bacteria counts are properly made of Pasteurized milk from a given plant, with the bacteria count of the raw milk running fairly uniform, and the Pasteurizing process accurately and properly controlled, the counts will be quite uniform from day to day for any given period of the year in which climatic conditions are the same.

It sometimes happens, however, that the count may rise greatly for a few days and then drop again to normal.

This presents a problem for the laboratory either of the health department or the milk dealer. A jump in count of this nature may be due to at least three things: First, a lowering of the Pasteurizing temperature; second, heavy contamination after the heating process; or third, the presence of an unusual number of heat-resistant nonspore-forming bacteria.

The count alone does not indicate which of these three conditions may be the cause. If due to a low temperature or to contamination after heating it is serious; if due to an unusually high proportion of resistant bacteria no harm results, unless there are bacteria standards to be met or ratings for the milk dealer to consider.

A situation of this nature calls for cooperation between health authorities and milk dealers to locate the cause of the trouble. Since the count alone does not give an explanation, it is necessary to go to the plant. If the Pasteurizing temperature, holding period, and sterilization of apparatus and bottles are found to be satisfactory, then the high counts are quite certain to be due to resistant bacteria.

In this case the laboratory can readily detect the farm supplying milk with an unusually high proportion of resistant nonspore-forming organisms. To do this it is only necessary to take composite samples from individual shippers, then make a bacteria count of the raw milk, and again after Pasteurization, at the temperature used in the plant with same holding period. The Pasteurizing process must be carried on in sterilized containers under controlled laboratory conditions. Usually one or more producers can be found whose milk will show only a very low percentage bacteria reduction. If the dealer so desires, milk from such producers can be refused until bacteria flora of the milk becomes normal. Cleaning up at the farm, with sterilization of utensils, will usually remedy the trouble.

In my opinion, increased count due to an unusually high proportion of these organisms in raw milk is not a health issue. It is quite plain, however, that they complicate bacteria standards for Pasteurized milk.

The statement that occasional high counts are not a health issue must be qualified slightly. It is not a health issue if it is known by plant inspection that all the milk was heated to the proper temperature and handled without reinfection.

Within the last year or two there has been considerable agitation over the appearance of so-called pin-point colonies on plates made from Pasteurized milk. These very small colonies occasionally appear in large numbers in proportion to other more regular-sized colonies. Recent work in our laboratories has shown that these pin-point colonies are due to a nonspore-forming thermophile. It is found in small numbers in raw milk and grows rapidly at the Pasteurizing temperature. This organism apparently causes a sort of accumulative contamination in Pasteurizing vats unless they are thoroughly steamed after the daily run. The organism is killed by heating for three minutes at 180° F.

There appears to be no cause for alarm over the presence of this thermophilic organism, for it appears commonly in raw and Pasteurized milk, and therefore has been consumed without giving evidence of causing trouble. It grows slowly at normal temperatures and is probably of less importance than many other bacteria found in milk.

The presence of these thermophiles probably indicates insufficient steaming of apparatus in milk plants, and in this connection its presence is suggestive. Further information about pin-point colonies will be published elsewhere.

EFFICIENCY OF PASTEURIZATION DEPENDS ON TWO THINGS.

Of the two most important steps which contribute to the efficiency of Pasteurization the first is to be sure that the proper temperature and holding period are used, and the second, to see that milk so treated is not reinfected with pathogenic organisms. Bacteria or chemical tests will not check these points, so other means must be found. Direct observation of the process at the plant by a person familiar with the bacteriological and mechanical details of the Pasteurizing process provides the best means of maintaining the efficiency of Pasteurization. I wish particularly to emphasize the importance of proper heating and holding, and also the prevention of reinfection.

First, let us consider the temperature and holding period. It is well known that pathogenic bacteria are destroyed when milk is heated to 145° F. for a period of 30 minutes. Every effort should therefore be made to see that Pasteurized milk be heated to this temperature and that every drop of milk be held for 30 minutes. Recording thermometers are the common instrument for supplying this information, but it is necessary to understand their peculiarities. A recording thermometer must be set so that its readings agree with a standard thermometer. Furthermore, it should be checked each day. If the bulb is in a tank during steaming it may not return to its proper point upon cooling, and so may read high. As a result, in the next Pasteurizing run, the temperature will be low. In some cases the chart may record the holding period, in other cases it does not. Fake records can of course be easily made.

Temperature control and the holding period are so important that a failure to meet requirements may nullify the whole process. Automatic temperature control is necessary, but no instruments have been devised to accomplish this and record the results without intelligent care in operation. Such care must be exercised, day in and day out, and there must be a realization by those concerned, of the seriousness of failure at this point in the process.

Unless health authorities can have an inspector at each plant, they must rely, to a large extent, upon the dealers to properly control temperatures and holding periods, and no dealer can afford not to meet this obligation. It is my belief that the constant control which the dealer gives to this part of the process plays a predominating part in the efficiency of Pasteurization. When a milk dealer is found who is lax in temperature control, it must be due to ignorance of its importance, for no sane man would endanger his plant investment by improperly Pasteurizing and running the risk of an epidemic.

When milk is known to have been heated to the proper temperature and held the proper length of time, there can be complete assurance that it is free, at this point in the process, from living pathogenic bacteria. All that remains is to handle it in such a way that it reaches the consumer in this same condition. It is during this period, when cooling, bottling, and delivering the milk, that means must be taken to prevent reinfection by pathogenic organisms. The danger of such infection from coolers, bottlers, and bottles can be taken care of by a proper system for sterilizing. The effectiveness of a sterilizing system is a question of daily plant inspection, and here again much responsibility rests upon the dealer. Bacteria counts of washings over apparatus and from bottles serve as a check on the process.

There are other potential sources of infection of Pasteurized or raw milk, and any food, in fact, which deserve much thought. These are diseased employees and carriers. Efficiency in Pasteurization can not be complete without the elimination of danger of infection from such persons, and this applies as well to raw milk. No health department can feel that its control is complete, and no dealer can feel that his products provide unquestionable safety, unless all employees who handle milk at any time after Pasteurization have been medically inspected. It is a simple process for a person suffering from disease or a carrier to infect milk or any other food material. I realize it is difficult to provide a suitable system of medical inspection, but it must be accomplished. This sort of inspection is carried on in some cities and as its importance is realized it is certain to become general.

SUMMARY.

Efficiency in Pasteurization depends on—

First. Maintenance of proper Pasteurization temperature and holding period.

Second. Prevention of reinfection by pathogenic organisms after Pasteurization.

The maintenance of these conditions can be best provided by intelligent supervision at the plant, and should be supplemented by bacteria tests properly applied and interpreted. An effective system of medical inspection for milk handlers must also be provided.

Chairman **Weld**. Mr. Ayers' paper is one of the most important contributions to our list of papers on Pasteurization.

Dr. H. W. **Redfield** (United States Bureau of Chemistry). I would like to say that favorable investigations have been carried out, and they show that if milk is heated to 142° and kept at that temperature or above it will be absolutely safe milk and does not need to be heated to 145°.

Doctor **Hastings**. I want to express my appreciation of this most valuable paper. Mr. Ayers makes mention of the self-registering thermometers. It is absolutely essential that these thermometers be accurate at all times. We have these installed in all of our Pasteurizing plants. We imported them from Europe, and a daily supervision has found that they are thoroughly reliable in every respect. That point, together with the capping of the bottles, is one of the most important steps along this line. I believe that all bottles should be capped by machinery. That is the only way to safeguard this process, and I think it is the endeavor to make it as nearly foolproof as possible.

Dr. HARRY A. HARDING (Matthews Advertising Corporation, Detroit, Mich.). In the machinery that is used in the larger plants, especially that which runs from 6 to 10 hours, there can and does occur a piling up in the machine. This piling up adds to the bacterial count, particularly toward the latter part of the run.

Chairman WELD. The next paper will be the "Supervision of the Pasteurization of milk by State authorities," by Mr. H. A. Whittaker, director, Minnesota State Board of Health. This is a paper that will perhaps cover a great many of the points which some of you have in mind. I take pleasure in introducing Mr. Whittaker.

THE SUPERVISION OF THE PASTEURIZATION OF MILK BY STATE AUTHORITIES.

HAROLD A. WHITTAKER, director, division of sanitation, Minnesota State Board of Health, Minneapolis, Minn.

Pasteurization is now recognized by health authorities as the most practical means of rendering market milk safe for human consumption. It is very gratifying to find that the general public is rapidly acquiring an appreciation of the importance of Pasteurization as a health measure; on the other hand, it is likewise discouraging to find that there are still a few active obstructionists to the process at the present time. These obstructionists are undoubtedly sincere in their conviction that it is possible to obtain a safe raw-milk supply under practical conditions. This ideal would be desirable if it were possible to attain it, but the cost of producing, handling, and supervising a raw-milk supply to meet the requirements necessary to insure safety is so great that it would place the price of the product above the reach of the average consumer. A study of the relative cost of the proper supervision of a raw-milk supply and a Pasteurized milk supply of a city of 20,000 population in the State of Minnesota, showed that it would cost several times as much to supervise the raw-milk supply in order to give the same relative protection from a health point of view. Even then, it is questionable whether the same protection could be guaranteed on the raw milk supply, since there are still many details in its supervision that have not been perfected to provide the necessary safeguards that would insure a safe product at all times.

The history of the application of purification to water supplies is somewhat analogous to that of the Pasteurization of milk. For many years, municipalities attempted to police the water catchment areas of surface water supplies in order to keep out every possible means of contamination. This was found to be exceedingly costly and difficult, since it required the control of extensive water catchment areas, and the maintenance of a large corps of sanitary inspectors to prevent the pollution of the supplies. It soon became evident that the most practical method of making surface water supplies safe for public consumption was to apply some means of purification. The practice quite generally in use at the present time is to limit the pollution of surface waters which are used as sources of public water supplies to such an extent that the modern methods of water purification can effectively remove any contamination which may be present in the raw water. This practice reduces the detail inspection work on the catchment area to a minimum and makes it possible to concentrate the supervision on the water purification plant where it can be more easily controlled.

The same practice is now applied to the supervision of milk supplies, particularly in the larger cities. It is impractical for most cities to provide the large number of inspectors necessary to carry on the supervision which would render raw milk reasonably safe; on the other hand, a limited number of inspectors can provide a reasonably clean product to the Pasteurization plants, and can concentrate their supervision on the Pasteurization process. The desirability of a raw-milk supply may be evident, but until some practical, inexpensive method of supervision for its protection can be devised, Pasteurization must remain as the greatest practical safeguard available for the protection of human health against the diseases transmitted through milk.

There are certain principles that should be observed in the production of a satisfactory Pasteurized milk supply. The following points are some which may be emphasized as of primary importance:

(1) The milk to be Pasteurized should be produced by healthy cows and handled in such a manner that it is not materially changed in composition by the action of bacteria or by the addition of foreign materials before it reaches the Pasteurization plant.

(2) The Pasteurization plant where the milk is processed should be properly constructed, and operated so that the entire treatment of the product, including Pasteurization, cooling, bottling, storing, etc., is satisfactory from a sanitary point of view. The same principles should apply to the methods of delivery to the consumer.

(3) The personnel of Pasteurization plants engaged in the production, Pasteurization, bottling, or cleaning of milk apparatus and utensils should be free from communicable diseases transmitted through milk as determined by the necessary medical and diagnostic laboratory examinations.

The milk consumer must have more protection than is provided by the individual dairyman and milk dealer. For this reason it is necessary that the supervision of the Pasteurization of milk be undertaken by State or local government units. These should be armed with the necessary legal authority to enforce the requirements, and they should be willing to cooperate with the producers and the distributors of the milk. It is most essential that State supervision be carried out in close coordination with local control. The States should have laws or regulations to cover the general essentials, but should leave the details of supervision to the local communities. The State law should authorize local government units, especially incorporated municipalities, to regulate their milk supplies under the general supervision of the State. It is advisable that the State laws and regulations should include general requirements for the dairies producing the supply, the Pasteurization plants, and the health of the persons engaged in the Pasteurization and subsequent handling of the milk. These State laws or regulations should set minimum requirements which can be further elaborated by the local units. The duties of the State in most localities must be confined to general standardization, and to the specific regulation of physical conditions, such as the construction and equipment of dairies, Pasteurization plants, etc., rather than to the enforcement of operating procedure. It would be impossible for most States to make all of the detail requirements for general application throughout a State on account of the varying conditions, but it is possible to cover certain fundamentals. The State should be in a position to assist the local communities in initiating and establishing regulatory measures which are consistent with the State standards, and to cooperate with them in the enforcement of such enactments.

It may be of interest to outline the experience of the Minnesota State Board of Health[1] in the supervision of milk Pasteurization in the State, the coordination of this work with local control, and the results obtained from these activities. An investigation of the supervision of the Pasteurization of milk from a health point of view was made in Minnesota during the year 1917. The information obtained at that time showed a need for immediate action in order to improve existing conditions.

The investigation included a detailed study of the Pasteurization plants, including their equipment and methods of operation, and the local supervision, if any, that was provided by the communities in which they were situated. These studies brought out certain important facts, which may be summarized briefly as follows: Pasteurization, in most instances, was not carried on as a health measure, but simply to improve the keeping quality of the milk or as an advertising feature. The latter may be illustrated by the fact that five plants were found labeling their product "Pasteurized milk" when they did not own any Pasteurizing apparatus. Many of the Pasteurization plants were not constructed so that the milk could be effectively Pasteurized. Defects in construction were found both in the buildings and in the plant equipment. As an illustration, not a single plant, except those in the three largest cities in the State, was equipped with a recording thermometer, and the dairy thermometers which were in use at many of these plants were found to register incorrectly from 1° to 10°. Many of the plants were operated by men who had little, if any, appreciation of the health significance of the Pasteurization process. Not a single community was found in the entire State where the employees, engaged in processing the milk at the Pasteurization plants, were required to pass a medical examination to determine that they were not chronic carriers of infectious diseases transmitted through milk. No local supervision was found except in the case of a few of the largest cities. Very few of the municipalities had ordinances regulating their milk supplies, and these ordinances in most instances did not contain provisions regulating the Pasteurization of milk.

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[1] The writer wishes to acknowledge the excellent work of Dr. R. W. Archibald, bacteriologist of the division of sanitation, Minnesota State Board of Health, whose efforts have contributed so much to the success obtained in the improvement of Pasteurized milk supplies in Minnesota.

These investigations showed very conclusively that the unsatisfactory conditions were largely the result of inadequate supervision on the part of the State and local communities, and should not be charged against the milk dealers.

The State board of health took the following steps toward improving these unsatisfactory conditions: The State departments interested in the milk-supply situation were called together to develop a plan for the coordination of their activities and to discuss the best means of starting a campaign to improve conditions. It was decided that the most important step was to provide an ordinance for local adoption. An ordinance adaptable to all but the three largest cities in the State was prepared and approved by these State departments.

Regulations were passed by the State board of health which defined Pasteurization, required the approval of plans and specifications on all new Pasteurization plants, required the medical examination of certain employees at Pasteurization plants, and prohibited insanitary conditions at Pasteurization plants.

The division of sanitation of the State board of health was instructed to begin an active campaign to improve milk supplies throughout the State. The work included propaganda toward establishing local supervision of milk supplies and the general supervision of Pasteurization plants.

The activities directed toward establishing local supervision included: (1) The distribution of literature on milk in relation to public health, to attract attention to the problem: (2) assistance to local officials and organizations in the investigation of municipal milk supplies in order to determine their sanitary condition; (3) aid in the passage of the milk ordinance approved by the various State departments; and (4) assistance to municipal officials in organizing the details of local supervision after the ordinance had been passed.

The work on existing Pasteurization plants covered an investigation of each installation to determine whether or not the equipment of the plant and the methods of operation were satisfactory. In the case of new plants the regulations require the approval of plans and specifications before construction is begun so as to prevent unsatisfactory buildings and equipment. In all cases where defects in equipment or operation were found, specific recommendations were made for their correction. Follow-up investigations were made on all plants as soon as notice was received that the recommendations had been carried out. It was the policy of the division of sanitation to turn over the detail supervision of the operation of the plant to local officials just as soon as the equipment of the plant and the methods of operation were found to meet the requirements of the State board of health. In cases where no ordinances had been passed to provide for local supervision, an effort was made to establish local supervision.

The division of preventable diseases of the State Board of Health cooperated with the supervision work on the medical examination of personnel at Pasteurization plants. The medical examination was confined to those persons engaged in the Pasteurization, bottling, or cleaning of milk apparatus and utensils. The examination, required by the division of preventable diseases, includes an inquiry into the communicable disease and vaccination history of applicant, and a physical examination, to exclude acute and chronic infections, both superficial and deep seated. The taking of nose and throat cultures is a routine procedure to exclude diphtheria carriers. The Widal test is also made as a matter of routine, and whenever the Widal reaction is present or atypical, or there is a history of typhoid fever, bowel and bladder discharges are examined to exclude carriers of typhoid infection. If tuberculosis, syphilis, or other acute or chronic infection is suspected, the proper laboratory examinations are made. In addition, the owner is required to exclude from work any employee suspected of having any acute infection, including sore throat, "cold," or minor purulent affection of skin or mucous membranes and to report the same immediately to the health officer.

These activities have been carried on since 1918, with the result that 65 municipalities have passed the proposed milk ordinance recommended by the State departments; the equipment and methods of operation of all of the Pasteurization plants, under the jurisdiction of the State board of health, have been approved, or the owners have been required to discontinue labeling, advertising, and selling their product as "Pasteurized milk."

Investigations made on the plants since this supervision was established have shown a marked improvement in the routine methods of Pasteurization and in the sanitary quality of the milk. Before supervision was established, the bacterial counts of the Pasteurized milk from most of the plants varied from one to several million; since improvements have been made at these plants, the counts run quite consistently below 50,000 per cubic centimeter.

The principal reason why any department of the Government is interested in the supervision of the Pasteurization of milk is that such supervision affords protection to the public from diseases that may be transmitted through milk. The question is sometimes raised as to which department of the State or local government should be assigned the duty of supervising the Pasteurization of milk. It would be folly for anyone to lay down an arbitrary rule, specifying the particular branch of the Government that should be charged with the responsibility of the sanitary supervision of milk supplies, since conditions vary throughout the country. Most State boards or departments of health are equipped with administrative officers, and with subdivisions which undertake the necessary technical and educational activities that can be coordinated to bring about effective supervisory and enforcement work. They are equipped with divisions of sanitation or sanitary engineering, employing personnel who can deal with the problems involved in the construction and operation of Pasteurization plants, including the approval of plans and specifications of new installations, and routine investigations on existing plants; divisions of preventable or communicable diseases, employing trained epidemiologists to supervise the medical examination and personal hygiene of the employees at dairies and plants, and to investigate the communicable diseases that may be associated with milk supplies; divisions of child hygiene, public health education, and public health nursing, employing educational workers, trained nurses, social workers, etc., who are in a position to carry on educational work, which will create a desire on the part of the communities to improve their milk supplies, and to teach an appreciation of the food value of good milk; and divisions of vital statistics for the recording of morbidity and mortality statistics, information which is important in showing the need for milk supervision work and the results obtained.

Local boards of health are equipped with medical health officers, who are entrusted with the enforcement of the health measures, and should be as well qualified as anyone in the average community to assume the general supervision of the local milk supplies from a health point of view; milk inspectors, who work under the direction of the local board or department of health, and coordinate their sanitary inspection work on dairy herds, dairies, and Pasteurization plants with the medical inspectors' work on the examination of employees, and identification and suppression of communicable diseases associated with milk supplies. Experience in Minnesota has indicated that veterinarians are usually the persons best qualified in the local communities to assume the duties of milk inspectors.

There is a great need at the present time for uniform standards of the general requirements for the Pasteurization of milk. This can be well illustrated by the variety of definitions for Pasteurization that appear in State laws and regulations and municipal ordinances on this subject. Information reported by the committee on milk supply of the sanitary engineering section, American Public Health Association, in 1920, showed that three Federal departments had officially defined Pasteurization, and all of these definitions differed as to their requirements. Ten States had officially defined the process, and an analysis of these definitions showed that only two States had nearly uniform requirements. It would seem that the time has come when an agreement could be reached on some of the fundamentals relating to the Pasteurization process, and especially on such an important principle as a uniform definition for the Pasteurization of milk.

It is undoubtedly true that the variety of local conditions found throughout the country, or even in one State, makes it impossible to have entirely uniform requirements on all phases of supervision work, but there are certain fundamental requirements which should be uniform. For example, it would be ridiculous to state that the temperature and time requirements for Pasteurization in one State or city in this country should be different from that of another, but that is the situation which actually exists at the present time.

It is the opinion of the writer that some official agency should call together a representative group of Federal, State, and municipal officials, with representatives from the various organizations interested or affected by regulatory measures, to discuss the standardization of certain fundamental features relating to the Pasteurization of milk. It would seem that the logical agency to call together such a group would be a Federal department, and the one most interested in the health supervision of milk. In 1922, the Surgeon General of the United States Public Health Service called together such a representative committee to aid the service in the revision of the United States Treasury standards for interstate water supplies. This committee is now functioning, and a great good should result from their deliberations. It is hoped that some Federal department may see merit in the plan suggested, and act, for there is certainly a great need for some official meeting place for Federal, State, and municipal officials with the representatives of the great technical and trade organizations, who have all played their respective parts in the progress made thus far in the improvement of milk supplies, both from a health and from a commercial point of view.

Chairman **Weld**. Is there any discussion of Mr. Whittaker's paper? He has brought out some facts which show clearly the improvement which may result from the regulation of supervision of Pasteurization of milk by State authorities.

Dr. H. W. **Redfield**. Various investigations have been conducted along this line. In New York, the Federal Government, the New York State government, and the New York City government and a number of leading men helped us in the educational work, and their findings will be published, I think, in the Public Health Service in the near future.

Mr. **Whittaker**. That is a point I wanted to bring out. There is a function for some committee that would carry this out. That was one of the things I was thinking about when I mentioned my committee.

Chairman **Weld**. The next paper has for its subject "Milk in relation to child life and health." The author is Mr. Ben Davies, of the United Dairies (Ltd.), London, England. In the absence of Mr. Davies, the paper is to be read by Mr. Tudor Price, the son of Sir William Price, director of United Dairies. Mr. Price. [Applause.]

MILK IN RELATION TO CHILD LIFE AND HEALTH.

Ben Davies, United Dairies, Ltd., London.

When one regards the great mass of critical literature on the milk question, the wonder grows that milk should still be held in such high esteem. Milk suffers the criticism of the learned, the half learned, and the ignorant. Its alleged faults have been the excuse for drastic experiments in legislation, which have been heralded and placarded by would-be reformers, by sensation-loving journalists, as well as by fanatics, fools, and faddists, few of whom are ever halted by a sense of limitation due to our possible ignorance of vital factors of the problem. The farm, the cow, the dairy, and the dairyman have been indicted for the high rate of infant mortality, for the spread of tubercle, and for that scourge of baby life, diarrheal disease. The effect of much of the propaganda in favor of graded milk and the like has been to undermine confidence in the supply of milk which is ordinarily available. In many cases it appears that this is the deliberate intention, and that 99 per cent of the milk supply is thus slandered, in order to make a market at a higher price for an ultimate 1 per cent. It is idle to extol the virtues of milk, its food value, its vitamins, or its importance in household economics, and at the same time to suggest that the only supply available is likely to be a menace to health and even to life, as is not infrequently done.

How much of this is true? Could a dairy congress better apply its time than to the consideration of a topic so vital, so fundamental in its influence on legislation, on administration, and on human welfare, particularly in all great centers of population? Let it not be thought there is no more to be known on such matters. There is always the vast difference between knowledge and understanding. "Knowledge comes, but wisdom lingers." The true import of and inference from acknowledged facts may not be known, and may result in a false suggestion which effectually suppresses the truth by sending us to seek relief in a wrong direction. The tragedy of suffering is as much a tragedy of active error as a tragedy of passive ignorance. Many a stronghold, invested by enemies, has fallen because its defenders, while watching vigilantly in many quarters, still left open to insidious attack an avenue supposed to be naturally secure. And for this reason it is true that one might discover the worst enemies of baby life among those who count themselves its best friends.

The object of this paper is not to escape responsibility which may properly be laid on producer and distributor on the score of health and decency. Its purpose is to consider whether the ordinary milk of commerce is responsible for illness among children, and if so, to what extent, and for what reason. Further, and to put the matter quite plainly, whether "any old milk" is not infinitely more advantageous than no milk at all; and, finally, what steps are necessary to give a supply which is absolutely safe at reasonable cost, and which can be made available in every large city within such reasonable time as perhaps several years. Its purpose also is to help in saving the lives of babies, which are being and will continue to be sacrificed in myriads the world over, while in our ignorance we know not how to shield them, nor, indeed, what it is that we have to shield them from.

Multitudes imagine that the chief use of milk is for the sustenance of babies and children. This is a great mistake, for the great bulk of milk in one form or another is consumed by adults. But the driving force in legislation and administration comes from the importance of pure milk for the nourishment of the human infant, and therefore the problem must be studied from this standpoint, and by regarding the progress of a baby as the most sensitive index we can have of the value of its food. A high rate of infant mortality is a reflection on the morals and intelligence of any community that suffers it, but until we have traced the cause of the trouble we shall continue to wallow in a morass of costly, harassing, and ineffective expedients. To quote a great authority, Newsholme: "To act helpfully we must know thoroughly the summation of conditions which form the evil to be attacked."

There are three distinct considerations which have to be taken into account when legislating on the milk question, viz, (1) health, (2) sentiment, and (3) economics. Each has its place, and they can not be confused without danger. The consumer has a right to require that all milk, and not merely a particular grade, be produced under conditions which attain a proper standard of cleanliness, if for no other reason, than merely as a matter of sentiment and decency. And an offense against that standard should involve prompt and condign penalties. Let producer and distributor exalt their office, and treat milk with the respect it deserves, and it will grow in appreciation and value in the eyes of the user. At the same time, one must recognize that a matter may be uneconomic without being dangerous to health—for instance, the souring of milk—and while any contamination may be offensive to sentiment, some contamination may be innocuous as regards any effect on health.

It is not necessary to search the records and statistics of the world in order to understand the case. This rests upon a few incontrovertible facts which apply with equal force to all large cities. These fundamental facts have been known for many years—for two decades at least—though their significance has been grasped by relatively few of either our legislators or our health administrators. And it is doubtful if even among communities where infant mortality has been most successfully reduced there is any clear understanding as to which of all the efforts put forth is chiefly responsible for such reduction.

It is agreed by responsible authorities that infant mortality tables afford a reliable index as to the sickness rate among children—that the "damage rate" closely corresponds with the death rate. A casual consideration of infant mortality tables—the writer has only in detail those of England and Wales, although having a general familiarity with those of the United States—shows that apart from congenital causes and prematurity and immaturity, the chief causes of infant deaths are bronchitis, pneumonia, diarrhea and enteritis; that measles, and especially whooping cough, are infinitely more serious causes of death than any single form of tuberculous disease; that since 1906 there has been a great fall in the number of deaths from diarrheal disease; and that the deaths from pneumonia and bronchitis remain much the same. These last three diseases still account for over 30 per cent of all infant deaths.

In order to attain a sense of proportion, the figures under the aforementioned headings are appended for three years, 1906, 1911, and 1921, these years having been chosen because they were alike for prolonged and excessive summer temperatures, which have always proved inimical to infant welfare. The figures for atrophy, debility, and marasmus should also be included, but a difference in the form of the tables for the year 1921 makes this difficult. It is enough to state here that the death rate under this heading has about halved in 1921 as compared with the earlier dates.

Infant mortality—England and Wales.

	1906	1911	1921
Deaths per thousand births (infant mortality rate)	132.50	130.06	82.76
Measles	2.26	3.16	.62
Scarlet fever	.12	.08	(?)
Whooping cough	4.25	4.14	2.69
Tubercle (all forms)	4.92	3.81	1.54
Convulsions	13.22	9.68	5.09
Bronchitis	8.45	8.28	5.35
Pneumonia	9.75	9.89	9.45
Diarrhea and enteritis	30.77	36.20	13.79

Let us begin with tubercle, for which it has been widely alleged that milk is a seriously responsible cause. The foregoing table shows there has been a great decline in the number of deaths from this cause. Tubercle reveals itself in protean form. The local government board of England and Wales states, as a result of an inquiry made on its behalf, that "it is likely that tuberculosis among children in England is commonly of human origin in five-sixths of the cases, while about one-sixth of them are of bovine origin." If this same ratio applies to the mortality, then it would mean that in 1921 there was 1 death from bovine tubercle for every 4,000 births. Let us declare that we will never rest until the safety of the milk supply has been absolutely verified; but, at the same time, we ask what warrant is there here for alarmist and malignant attacks on milk?

Let us look at the question from another standpoint, that of the reactions to tuberculin among cattle of different ages: Delépine (of Manchester) gave the following results:

	Per cent reactions.
Animals under 1 year	3. 4
Animals 1 to 2 years	13. 2
Animals 2 to 3 years	24. 1
Animals 3 to 5 years	33. 5
Animals 5 to 9 years	48. 9

Koch and Calmette, whose eminence and authority command respect, declare that human infection by bovine tubercle is unimportant. At all events there is no question, I believe, that bovine tubercle bacilli are more virulent to bovines than to humans. Is it not strange, therefore, if tuberculous milk is as great and as common a danger as some suggest, that so small a proportion of calves show signs of the disease? Older animals contract the disease in an accelerating ratio, but not from milk!

May we not assume, therefore, that a large proportion of such calves as contract the disease do so by direct infection from other animals, and but rarely from milk? It can not be supposed that calves are immune from channels of infection to which mature animals succumb.

No unprejudiced student can doubt the value of scientific Pasteurization in protecting milk from tubercular infection as from other infections. This process must be accorded no small share of the credit for the steady improvement in, for instance, the London milk supply in recent years. Thus, milk arriving at London railway termini for some years past has yielded a steadily decreasing number of tuberculous samples, as the following figures show:

	Per cent of virulent samples.
1917	10. 3
1918	7. 4
1919	6. 5
1920	5. 9
1921	3. 48

Most of the samples taken were of un-Pasteurized milk, but the proportion of Pasteurized milk is large and increasing, and must account for much of the improvement found.

It is also interesting to note that London, whose milk supply is more largely Pasteurized than that of other English cities, has but half the infant mortality rate from abdominal tuberculosis, although it has a death rate in excess of other urban districts from other tuberculous diseases.

To keep this paper within prescribed limits one must pass to other features of the subject. The greatest saving of infant life in recent years has been in connection with cases of diarrheal diseases. Comparing 1921, when the summer temperature was higher and more prolonged than in the other two abnormally hot years of the century, viz, 1906 and 1911, the decrease in the diarrheal death rate of that year, as compared with 1911, represented a saving of 13,725 lives. As regards pneumonia, there appears to be no decrease of the death rate since the beginning of the century. It is too soon to say whether the marked decrease in bronchitis mortality shown in 1921 is permanent, but it is encouraging, as also is the great and steady decrease in deaths from convulsions. With this grim quartette we must come to grips if we would banish the worst ills of infant life.

What is the infant mortality from bovine tubercle, of something like 1 death to 4,000 births, to compare with that of this group, which accounts for from a quarter to a third of all infant deaths? Is there then any common condition which accounts for them, and bearing in mind the object of our inquiry, is milk responsible; and if so, how?

Dealing with the latter part of this question first, it is difficult in the present day to secure evidence which is not affected by the great advance in the practice of Pasteurization, which excludes many potential dangers from the milk supply, and reduces others, and also by the widespread use of dried milk by the wage-earning class, which suffers most of the infant mortality. But, fortunately, evidence exists from a day when either of these factors had little if any influence on vital statistics in Great Britain. I quote from official documents of the British Local Government Board.

In the year 1908, Dr. Meredith Richards, its medical officer of health, wrote of the large town of Croydon:

> It is impossible to define social status very accurately, but for some time past it has been our custom to divide the births in the borough into two groups, namely, those occurring in large houses and those occurring in small houses. Generally speaking, every tenement of six rooms and over is considered a large house. Adopting this more or less artificial grouping, it is found that during 1908 there were 1,113 births in large houses, and of these only 49 died, a rate of 44 per 1,000, as compared with 2,884 births with 349 deaths in smaller houses, a rate of 121 per 1,000.

The milk used by either group would be of the same general character. There is no doubt that the class living in larger houses would use more of it, and if milk was necessarily the cause, would suffer a greater mortality. But there is more than that in it. As the report to the local government board remarks in this connection:

> This is the more instructive, in view of the fact that probably 80 per cent of the mothers of infants in wage-earning populations suckle their infants partially or entirely; and the proportion of mothers in well-to-do classes who are able or willing to continue to give their infants this immensely important start in life is believed, I think rightly, to be much smaller. There must be

reasons of great potency, enabling infants of the well-to-do to survive in much higher proportion to the end of the first year of life, notwithstanding this heavy handicap against them.

The foregoing refers to 1908. Let us go back still further, to a time when milk hygiene was still more rudimentary, to a time and place where Pasteurization and similar safeguards were practically unknown. In the year 1904, Dr. John Robertson, the medical officer of the city of Birmingham, recorded an investigation into every death in the city from infant diarrhea. It was found that practically all these deaths occurred in small houses occupied by the artisan classes. No deaths occurred in any middle-class or better-class house during the time of the inquiry. Some few deaths did occur in houses of over five rooms, but in each of these cases there were special circumstances which brought them within the meaning of artisan houses.

Here, where a milk supply of the same general character only was available, it was found that 100 per cent of the deaths from the cause most fatal to infants all over the world occurred among children of a particular class, and that the children of another class *using the same milk* suffered no deaths at all—and this in spite of the handicap of a lessened proportion of maternal feeding.

Diarrhea disease is perhaps the most deadly enemy of the children of the poor, but it has other and venomous allies. The same circumstances that provide the greatest number of diarrhea deaths, at another period of the year cause most of the deaths from pneumonia and bronchitis, these two diseases, which are linked together in occurrence with infant diarrhea, accounting for nearly 20 per cent of all infant deaths. Have they a common cause, and above all, is it milk?

Obviously it is not due to farm and dairy infection of milk. Neither, it would seem, is it due to the exposure of loose milk in the open street during delivery, since, were these the controlling factors, the result would be manifested in the death of children of every class alike. Tests made repeatedly in London show that the bacterial increase in loose milk delivery to the consumer is very small—provided that it be delivered from properly sterilized vessels—but that the increase in the home, where the milk is kept in ordinary jugs or other domestic vessels, is very great. One has not the space to quote many authorities, but the names of Sir Arthur Newsholme and of Sir George Newman command respect the world over. In his work on Infant Mortality Newman writes:

> Newsholme again points out that the evidence obtainable is all in support of domestic infection of milk rather than farm infection of milk. If diarrheal infection came from the farm we should expect three events which we do not obtain. First, there would be massive infection. Secondly, there would be the ordinary characteristics of milk-borne epidemics. Thirdly, there would be a higher incidence of fatal diarrhea among infants fed on fresh milk than on condensed milk. Not one of these characteristics do we obtain. * * * It is the condensed-milk fed infants that mostly die from diarrhea, not because condensed milk contains more organisms than fresh cow's milk (for it contains less), but in all probability because condensed milk is less nutritious and sustaining, *and is more liable to home contamination than cow's milk.*

Elsewhere Newman remarks:

> It can scarcely be denied that the evidence that diarrhea is due to domestic infection is overwhelming.

If further proof be required of this, it is found in the fact that the use of dried milk, in spite of other disadvantages, has been attended with a greatly reduced mortality from diarrheal and attendant infections. It is not that it is a better or as good a food as fluid milk, but the fact that it is dry until about to be used eliminates the danger of domestic infections which are so fatal. I will conclude this part of my paper with two quotations from Newsholme, the one from his report to the local government board on "Child mortality" and the other from his Public Health and Insurance:

> Towns with a high total child mortality have a high mortality from diarrhea, and from bronchitis and pneumonia. This and other facts point to the conclusion that these diseases are fostered by the insanitary conditions of the home and its surroundings.
>
> If pneumonia and bronchitis, which account for 19 per cent of deaths in infancy, be regarded as they should—as infective diseases—then it may be said that the problem of saving child life and securing the correlative improvement in the standard of health of children who survive to higher ages, consists very largely in the prevention of infections including diarrheal disease and acute respiratory diseases.

The foregoing all shows that, as at Croydon, the class using even the ordinary milk of commerce most liberally only suffered a rate of infant mortality approaching the most sanguine hopes of reformers, and that so far as milk is responsible for sickness it is overwhelmingly due to domestic infections and not to farm or dairy contamination.

The great value of Pasteurization in securing the purity and safety of the milk supply has already been acknowledged. It frees milk at once from the fear of tubercle and other epidemic diseases, as well as many obscure and mysterious troubles. But neither Pasteurization considered by itself, nor any better and cleaner method of production, will even touch the great causes of infant sickness, because these are things that are apart from the cow, the farm, or the dairy, and belong to the home. The enemy of man is man. As Sir George Newman wrote:

> It is not external environment which primarily affects the infant mortality, and produces that prematurity, pneumonia, atrophy, and much of the diarrhea which occur in infant life. The things are produced by some evil condition or conditions in the habits and homes of the people, which are, after all, the vitals of the nation.

The problem is how to protect the marvelous qualities of milk from the moment of delivery until it is consumed. Protect it from the infections which abound under certain conditions in the home of mankind—infections which are powerless against older people but to which the infant readily succumbs. The answer is contained in one word, "insulation." The beneficent influence of Pasteurization applied to milk has been beclouded by the failure to regard the influence the practice of bottling this Pasteurized milk has in protecting it from the subsequent and greater dangers which come from human infections. In those cases where systems of sterilization of milk have been organized by commercial, municipal, or philanthropic bodies, the credit for much of the good results obtained should be given to the insulating virtues of the bottle.

Where lies the purport of all this? Here. Tell the mother of a sick or dying baby that her child is ill because of something that happened on a far-away farm and she can do nothing but weep helpless, despairing, and rebellious tears. But tell her that the trouble is due to her own household, perhaps to her own hands, and show her how, with a little care, a little knowledge, and a little help the trouble can be prevented and her child raised to health and strength, and you fill her heart with happiness and hope, and with a purpose to guard her child from the enemy till then unknown. That American cities have so generally insisted on the Pasteurization of milk is to the credit of their civic intelligence. But so far as they fail to insist on the insulation of this good Pasteurized milk by universal bottling in sterile bottles, it is a ruinous debit. It is a debt that weighs the scales ruthlessly and hopelessly against the child. In the past, attention has been riveted on the cow, the farm, and the dairy. Let us get back to the home and show the mother that it is there that the child's life and health are won or lost; that the problem is more moral than material. And let us insist that in part the burden of protection be lifted from her weary hands and straightened means by giving her a milk which by Pasteurization and insulation is guarded from all save heartless carelessness and hopeless ignorance. So shall we best help to bring to pass the vision of the prophet looking for the new Jerusalem where "there shall be no more an infant of days, nor an old man that hath not filled his days, for the child shall die an hundred years old."

Chairman Weld. The next paper, the subject of which is "The relation of the melitensis-abortus group of organisms to human health," is by Miss Alice Evans. I regret very much to announce that Miss Evans can not be present. She is the bacteriologist of the United States Public Health Service; she is seriously ill, having contracted Malta fever as a result of her experimental work with this disease. Her paper is here, however, and if it is the desire of the body it will be read by the secretary, Doctor Roadhouse.

Mr. H. R. Estes (Flint, Mich.). I move that the paper be read at this time.

(The motion was seconded by Doctor Hastings, of Toronto, and carried. Secretary Roadhouse read Miss Evans' paper.)

THE RELATION OF THE MELITENSIS-ABORTUS GROUP OF ORGANISMS TO HUMAN HEALTH.

Miss Alice C. Evans, associate bacteriologist, United States Public Health Service, Hygienic Laboratory, Washington, D. C.

It is a curious circumstance in the history of bacteriology that during the greater part of its existence as a science it has recognized under two generic names, organisms which, since a comparison has been made, are now taxing the resources of investigators to find distinguishing characteristics. Both of these organisms have long been well known, the one being the so-called *Micrococcus melitensis*, causing Malta fever in man, and the other the so-called *Bacillus abortus*, responsible for contagious abortion in cattle.

Malta fever, known also as Mediterranean or undulant fever, is widespread in subtropical regions, and presents an important health problem in countries of the Mediterranean littoral, in South Africa, and we may add, in the State of Arizona in our own country. This disease exists also in India, China, and the Philippines, and it has been described in Peru. It has been said that Malta fever does not occur in Europe north of 46° latitude. There is, to be sure, no such definite boundary. Occasional outbreaks have been known to occur farther north. It is a fact, however, that in southern Germany, Hungary, Switzerland, and Czechoslovakia goat's milk is commonly used without the prevalence of Malta fever similar to that in neighboring countries to the south.

The causal organism of Malta fever was discovered by Bruce as early as 1887. Twenty years after this discovery, the British Commission for the Investigation of Mediterranean Fever published a report, in which it was definitely established that infected goat's milk is a common source of human infection. They found that infected goats generally evinced no symptoms of disease, although *melitensis* might be multiplying in the udder with the excretion of great numbers of the organism in the milk. Following the publication of this report the British Army and Navy forbade the use of goat's milk among their troops, with the result that Malta fever, which formerly had been a serious disease in causing a large percentage of men to be incapacitated for duty, was practically elimiated. The eradication of Malta fever from the British troops is one of the notable achievements of medical bacteriology.

The British commission established also that various other domestic animals became infected with the Malta fever organism. By testing the agglutination reaction of the blood serum, they found infected cows, mules, dogs, and cats. In none of these animals did they find symptoms of acute disease. It is notable that they found that the milk of infected cows, like that of goats, contained the Malta fever organism.

Ten years after Bruce had discovered the so-called *Micrococcus melitensis*, and ten years before the publication of the monumental report of the British Commission for the Investigation of Mediterranean Fever, Bang, in Denmark, discovered the causal organism of that serious disease of cattle, namely, contagious abortion. He named his organism *Bacillus abortus*. Bang had no reason to suspect a relationship between his organism and that causing Malta fever. He had no evidence that *Bacillus abortus* infected human beings. Moreover, his organism was a rod form, a bacillus, whereas the Malta fever organism was designated a micrococcus. That generic name micrococcus was destined to obscure the relationship between the Malta fever organism and that of contagious abortion for more than 20 years after Bang's discovery. The name stood as a guide post misdirecting bacteriologists to make no comparison of "*Micrococcus melitensis*" with any bacillus. We now know that the Malta fever organism is a rod form, and that the name micrococcus was a misnomer.

It was not until the year 1917 that a comparison of the two organisms was made. At that time I was working in the Dairy Division of the Department of Agriculture, and one of the problems that had been assigned me was a study of the bacterial flora of cow's milk drawn aseptically from the udder. It was found that, together with streptococci and staphylococci, there are commonly present in cow's milk small rod forms resembling *Bact. abortus* more or less in morphological, cultural, and biochemical characteristics, but generally lacking in pathogenicity. By inoculating guinea pigs with samples of milk, Schroeder and Cotton had shown in 1911 that virulent *Bact. abortus* is present in about 11 per cent of samples of cow's milk. Similar results have been obtained by several other investigators in various parts of this country. In spite of their prevalence in cow's milk, however, virulent strains could not be readily demonstrated by plating methods. I never succeeded in obtaining them by the plate method from the milk of spontaneously infected cows, but did obtain them from the milk of two experimentally infected animals. Later, Huddleson succeeded in plating *Bact. abortus* from the milk of spontaneously infected cows. He agrees, however, that *Bact. abortus* exists in cow's milk only in small numbers. This point is of some significance, and will be referred to again.

The finding of abortus-like organisms commonly in cow's milk led me to consult the investigators of the Pathological Division of the Bureau of Animal Industry, who had had clinical experience with *Bact. abortus*. During a conversation with Doctor Eichhorn, then chief of the Pathological Division, he asked me if I had ever compared *abortus* with the organism causing Malta fever. He did not say why he asked that question, but since he had had experience with Malta fever in goats, as well as with contagious abortion in cattle, he had presumably noted the similarity of the clinical aspects of the disease as it existed in the two species of milk animals.

Following Doctor Eichhorn's suggestion, I secured a half dozen available strains of *melitensis* and compared them with bovine strains, with the astonishing result that the bovine and human strains were indistinguishable morphologically and culturally; they gave the same biochemical reactions in various media; inoculation into guinea pigs gave identical results, and the serum of the animals inoculated with either, agglutinated as well with the other as with the homologous type of organism. Only by agglutinin absorption tests could the strains be differentiated.

These observations have been confirmed by Meyer and his associates in this country; by Zeller, Jaffé, and Skarić, in Europe; by Khaled, in Egypt; and by Burnet, in Tunisia. Some of these investigators have made further observations which have added substantially to the evidence of the close relationship of the organisms from the two sources.

Fleischner and Meyer, in California, found that the intradermal test, which they regard as highly specific, can not differentiate between an *abortus* and a *melitensis* infection in guinea pigs. Burnet, in Tunisia, found that human Malta fever patients show the same cutaneous hypersensitiveness whether *melitensis* or *abortus* is used as the antigen. Khaled immunized a monkey by treating with *abortus*, and found a mild reaction to an infecting dose of *melitensis*, as compared with an untreated control monkey. Several investigators have compared the disease in guinea pigs produced by experimental inoculation with *abortus* and *melitensis*. They all agree that the anatomic and histologic changes are so nearly alike for the two infections that they are indistinguishable.

In a recent experiment I was able to show that inoculation of cows with strains from human cases of Malta fever results in abortion.

Within recent years attention has been directed to contagious abortion in swine, a disease which is of increasing economic importance in this country. The causal organism has been found to be the same as that responsible for the disease in cows. The organisms of the melitensis-abortus group are therefore responsible for Malta fever in man and in goats; and for contagious abortion in cattle and swine and other animals. It has also been noted that abortion is one of the symptoms of the infection in goats.

It is important that a comparative study be made of a large number of strains from every species of animal in which the disease spontaneously occurs. During the present year I have collected a large number of strains of the abortus-melitensis group from human, bovine, porcine, caprine, and equine sources, and classified them according to the agglutinin-absorption test, with Feusier and Meyer's three type strains as the starting point for the classification. The strains came from various parts of the United States and Europe. They were found to fall into seven distinct types. Five of these types included only one, two, or three strains each, and they will be disregarded in this discussion. The great majority of strains fell into two large groups. One of these groups (or types) includes the majority of bovine strains and the majority of porcine strains, but it also includes two human strains. The other of the chief serological types includes the majority of human strains; it also includes one bovine strain and the only caprine strain and the only equine strain in the collection.

Summarizing the serological investigation it may be stated that the majority of strains of the melitensis-abortus group isolated from five species of animals fall into two distinct serological types. These two types are more closely related serologically than types I and II meningococcus or types I and II pneumococcus for the melitensis-abortus types can not be distinguished by the simple agglutination test. One type, which may be called the abortus type, is characteristically bovine and porcine; the other, which may be called the melitensis type, is characteristically human and caprine. The types are not restricted, however, to the host species for which they are characteristic.

The accumulating evidence of the close relationship between the strains of bovine and human origin has culminated in the conclusion of Burnet, that *melitensis* and *abortus* are not distinct bacteriological species, but merely distinct serological types of the same species. I concur in that conclusion.

Considering the array of facts which has established the close relationship between the causal organisms of Malta fever and of contagious abortion in cattle, the question arises with increasing emphasis why no recognized disease resembling Malta fever results from drinking raw cow's milk, for there is no doubt that a large part of our population has at some time or other ingested virulent *abortus* organisms.

As in every case of infection or immunity, there are three factors concerned—the virulence of the microorganism, the number of bacteria which gain entrance to the tissues, and the resistance of the host. There is at hand a certain amount of information, though meager, relating to these factors as applied to *melitensis* and *abortus.*

The British investigators found by the plate culture method that about 10 per cent of goats on the Island of Malta were excreting *melitensis* in their milk. They found commonly 30,000 organisms per cubic centimeter, and they state that frequently a figure of 3,000,000 per cubic centimeter would be more nearly the correct number. In contrast to these figures for goat's milk, only two or three investigators have reported success in obtaining *abortus* from cow's milk by the plating method, and they agree that there are few of these organisms present in the milk of infected cows. It is only by inoculation of milk into guinea pigs which are susceptible to infection by a very few organisms, that the prevalence of *abortus* in cow's milk has been established.

The common use of goat's milk in central Europe without the prevalence of Malta fever has already been mentioned. It suggests a possible regional susceptibility to the disease, or a possible increase in the virulence of *melitensis* in subtropical regions.

The comparative virulence of bovine and human strains has been tested on monkeys by Meyer and his associates in California. In their feeding experiments they found that human strains were far more invasive, causing infection of the monkeys when small doses were used, as compared with the doses of *abortus* necessary to cause infection. These results, and the fact that there is no recognized acute disease in man caused by the ingestion of cow's milk infected with this species of microorganism, suggest that passage through generation after generation of cattle may have reduced the virulence of these organisms for man and monkeys.

It must be conceded that, in general, the bovine *abortus* does not cause in man such an acute disease as the Malta fever of subtropical regions. It would be a careless indifference to the prevalence of the organism, however, to conclude that it is harmless in temperate climates where cow's milk is more generally used.

In subtropical countries Malta fever manifests itself by such a great variety of symptoms that medical authorities are agreed that the only possible way to diagnose it with certainty is by laboratory methods, i. e., by the cultivation of the microorganism, or by serological tests. The disease also varies from the acute form, which occasionally ends fatally, to a mild, ambulatory type. The British commission found native Maltese "carriers" of the organism who asserted that they had never had Malta fever. It would appear to be a problem worthy of investigation to determine whether *abortus* infection might not be responsible for mild disabilities in our own localities—for the cause is never determined of many cases of low fever, or bronchial cough, or rheumatism, or neuritis, or other mild symptoms of disease, such as are common in Malta fever.

During the present year I have made serological tests for *melitensis* or *abortus* infection with 500 samples of human serums. Most of these serums were sent to the Hygienic Laboratory from veterans' hospitals to be tested for the Wassermann reaction. A part of them were taken in the naval hospital at Washington, D. C., for the same purpose. The serums were therefore taken from people who were suffering with an ailment of some kind or other so that they had presented themselves at a hospital for diagnosis. Of the 500 serums, 57, or 11.4 per cent, gave a definitely positive agglutinin reaction. In seeking an interpretation for these results the opinion of investigators in countries where Malta fever is endemic must be taken as a guide. We have also the data showing the titer of agglutinins in 9 undoubted human cases of Malta fever contracted in Arizona in 1922 or 1923.

Fici, an Italian, has recently summarized all of the literature on the specificity of the Malta fever agglutinin reaction with the conclusion that it is a specific diagnostic test.

Nicolle believes that a positive reaction in a 1:10 dilution indicates a *melitensis* infection.

Bassett-Smith, who has had a wide experience with Malta fever in Mediterranean countries, is of the opinion that a positive agglutination in the 1:30 dilution of serum may be considered conclusive evidence of Malta fever, past or present. He adds that the serum of several of his patients who were undoubtedly suffering with Malta fever, as proved by the cultivation of the organism from the blood, gave a positive agglutination reaction in dilutions no higher than 1:10.

Of the nine serums from Malta fever patients who recently contracted the disease in Arizona, one had an agglutinin titer of 1:20. From this figure the titers varied to as high as 1:640 in one case.

Taking into consideration Bassett-Smith's and Nicolle's results and our own, it appeared that serums of an agglutination titer of 1:20 or higher should be investigated. There were five serums among the five hundred with a titer of 1:20 or higher. None of the patients from whom these five serums were taken had had any chance of infection from goats so far as they were aware. Agglutinin absorption tests with the serums showed that in at least two of the five cases the infection had been with the *abortus* type. In the other three cases the type of infection could not be determined by a study of the serum. The laboratory findings for these five patients would have led to a diagnosis of Malta fever if they had lived in regions where the disease was known to be endemic.

The significance of the agglutinin reactions in dilutions of 1:5 or 1:10 in the remaining 52 of the 500 serums is not clear. They may indicate a present infection; or they may be the result of a former infection; or they may be the result of ingestion of virulent organisms which the host disposed of without becoming diseased. There has been considerable written during recent years about vaccination by mouth, and Nicolle and Conseil have demonstrated that it can be accomplished with killed cultures of *melitensis*.

Several investigators in this country have previously reported that a considerable percentage of human serums gives a serological reaction with *abortus* antigen. The explanation has been either that the reaction was probably not specific, or that the individuals whose serum gave a positive reaction had absorbed the agglutinins from the cow's milk which they had drunk. These explanations are not satisfactory in the face of known facts. The exact significance of positive serological reactions of the melitensis-abortus organisms with human serums in temperate regions offers a fertile field for investigation.

If there were no other reason for milk Pasteurization, it would appear to be folly to drink raw milk containing the *abortus* organism With this in view leaders in the dairy industry should anticipate public health authorities in urging with renewed emphasis the general use of heated milk in country districts.

Dairymen who live on farms where contagious abortion is prevalent can aid the investigations now being carried on at the Hygienic Laboratory if they will note coincidences of illness in their families with the disease in cattle, and in case of such coincidence have their physician take a sample of serum to be sent to the Hygienic Laboratory, Washington, D. C. A report of the results obtained would always be made to the sender. This would be valuable information to the sender in case the results were positive; and a study of a few hundred such samples would yield important data obtained from a group of people among whom this disease is most apt to exist.

Chairman **Weld**. We have been obliged to pass over several papers this morning in the absence of the authors. Is it your desire that the papers be read by title?

Mr. **Ernest Kelly** (United States Department of Agriculture, Washington, D. C.). I move that the papers referred to be read by title.

(The motion was seconded and carried.)

(Adjournment.)

(Papers read by title):

QUALITÄTSBEZAHLUNG UND QUALITÄTSBELOHNUNG IN DER FINNLÄNDISCHEN MILCHWIRTSCHAFT.

Otto P. Pehkonen, technischer Direktor der Firma Valio, Cooperative Butter Export Association, Helsingfors, Finnland.

Die Einführung und Fortentwicklung der Qualitätsbezahlung in der finnländischen Milchwirtschaft steht in unmittelbarem Zusammenhang mit der genossenschaftlichen Organisation und Konzentration des Molkereiwesens in Finnland. Solange das Molkereiwesen im Lande durch Private und Aktiengesellschaften vertreten war—also bis etwa 1900—wurde bei der Bestimmung des Milchpreises nicht einmal der Fettgehalt als wichtigste Grundlage der Preisfestsetzung betrachtet, sondern die Molkereien bemassen den Milchpreis oft mehr nach anderen geschäftlichen Gesichtspunkten. Erst als die Viehbesitzer nach 1900 zur Gründung von Genossenschaftsmolkereien schritten, wurde die Basis der Preisbestimmung bei der Abrechnung über die Milch eine andere, indem die Genossenschaftsmolkereien von Anfang an die Milch nach deren Fettgehalt liquidierten. Für die Bestimmung des Fettgehalts der Milch wurde allgemein die Gerber'sche Säuremethode in Gebrauch genommen und für die Milch nach dem Fettgehalt in 1 Kg. Milch sowie für die Sahne pro Fettkilo bezahlt. Aehnlich wie die privaten Molkereien und die

Molkereien auf Aktien bei der Abrechnung über die Milch nur teilweise deren Fettgehalt in Betracht zogen, übersahen auch die privaten Butterhändler bei der Feststellung des Butterpreises oft grossenteils die Qualität der Butter und berücksichtigten bei der Preisbemessung mehr die Gesichtspunkte der Konkurrenz. Eine Wandlung zum Bessern trat auch in dieser Beziehung erst ein, als die Genossenschaftsmolkereien Finnlands unter sich das genossenschaftliche Zentralgeschäft Valio gründeten, das im Dezember 1905 mit seiner Tätigkeit begann. Valio führte nämlich von vornherein eine wöchentliche Qualitätsprüfung der Butter und Qualitätsbezahlung ein und arbeitete zugleich auch von Anfang an auf die Verbesserung der Qualität der Butter seiner Mitgliedermolkereien hin.

I. QUALITÄTSBEZAHLUNG UND QUALITÄTSBELOHNUNG IN DEN BUTTEREIEN.

Die Abrechnung mit den Molkereien.—Während den ersten Geschäftsjahre der Firma Valio, wo in Finnland noch keine staatliche Butterkontrolle bestand, wurde die Butterprüfung von drei mit dieser Arbeit vertrauten Funktionären der genannten Firma ausgeführt. Die Points wurden nach der Skala 1–15 gegeben, in der 1 die schlechteste und die 15 die allerbeste Qualität bedeutete. Bei der Zuteilung der Points wurden Geschmack, Geruch, Farbe, Konsistenz und Verpackung der Butter in Betracht gezogen. Fehler, die auf nachlässiger Zubereitung beruhten, wurden im allgemeinen streng beurteilt. Butter, die mindestens 10.7 Points erhielt, wurde als erstklassige Exportbutter gerechnet. Für Butter mit gleicher Pointzahl wurde derselbe Preis bezahlt. Der Preisunterschied pro Point war anfangs (1906) sehr unbedeutend, nur etwa 1 bis 2 Penni pro Kilogramm, aber schon im Jahre 1913 etwa 4 bis 5 Penni pro Kilogramm. Zwischen erstklassiger Exportbutter und zweitklassigem Erzeugnis, also zwischen den Points 10.7 und 10.3, ist der Preisunterschied erheblich grösser gewesen. In den Jahren 1906–1914 schwankte er, je nach den herrschenden Preisen, zwischen 4 und 8 Penni pro Kilogramm, und später, als die Preise während des Krieges stiegen, konnte er sogar 2 Markka betragen.

Solange es keine staatliche Kontrolle der Exportbutter gab, wurde nur die Butter der Mitgliedermolkereien von Valio von der Prüfung betroffen. Im Jahre 1913 wurde die Staatliche Butterkontrollanstalt gegründet, wonach alle Exportbutter der amtlichen Kontrolle unterworfen wurde. Die Staatliche Butterkontrollanstalt befolgt jedoch bei der Butterprüfung der Hauptsache nach dieselben Normen, die Valio früher aufgestellt hatte. Da der Export der Firma gegenwärtig etwa 85 Prozent, vom Butterexport des Landes beträgt und sie für die Butter nach der Qualität abrechnet, erhält der grösste Teil der Exportbutter zubereitenden Molkereien Finnlands heute für seine Erzeugnisse den Preis entsprechend der Qualität, zumal da auch die privaten Exportfirmen in letzter Zeit gezwungen gewesen sind, die Qualität der Butter bei der Berechnung mehr als früher in Betracht zu ziehen.

Die Qualitätsbelohnung der Butterbereiter.—Im Jahre 1921 begann Valio auch an die Butterbereiter seiner Mitgliedermolkereien Qualitätsbelohnungen auszuzahlen. Da die Voraussetzungen zur Herstellung der ihrer Qualität nach guten Butter in den verschiedenen

Teilen des Landes verschieden sind, wurden die Molkereien inbezug auf die Gewährung der Qualitätsbelohnung in drei Gruppen eingeteilt, in denen die Anforderungen von verschiedener Art sind. Der Qualitätsbelohnung wurden die von der Staatlichen Butterkontrollanstalt ausgeführten Prüfungen zu Grunde gelegt. Eine Prämie erhielt der Butterbereiter für alle die an Valio gelieferte Butter, die bei der Prüfung mindestens 10.7 Points in Gruppe I, 10.3 in Gruppe II, und 9.7 in Gruppe III, erzielte und nicht über 16 prozent Wasser enthielt. Die Höhe der Prämie war 75 Penni pro Zentner, wenn der Butter die obenerwähnten, für jede Gruppe bestimmten niedrigsten Points zuerkannt wurden, und 1 Markka 25 Penni pro Zentner, wenn die Pointzahl, in Gruppe I mindestens 11.3, in Gruppe II, 11.0, und in Gruppe III, 10.7 war. Ausserdem verteilt Valio alljährlich Spezialprämien an die Butterbereiter derjenigen Molkereien, deren Butter sich im Verhältnis zum vorhergehenden Jahr am meisten verbessert hat. Ferner erhalten noch die 25 Molkereien, deren jährlicher Butterpoint am höchsten ist, eine besondere ehrenvolle Erwähnung. Den Meiern und Meierinnen derjenigen Molkereien, die drei Jahre nacheinander eine solche ehrenvolle Erwähnung erhalten, gibt Valio eine Gratifikation in Bar und ein Diplom.

Anfang 1923 wurden die Verteilungsprinzipien der Qualitätsbelohnungen dahin abgeändert, dass die Einteilung der Molkereien in verschiedene Gruppen nach Produktionsgebieten aufgegeben und zum Ausgangspunkt der Beurteilung der Mittelwert der Points genommen wurde, die jede Molkerei im Jahre vorher bei den Prüfungen der Staatlichen Butterkontrollanstalt erzielt hatte.

Für jede Butterlieferung, die bei der Handelswertbestimmung mindestens den Point erreicht, der höchstens um 2.3 (0.66) Points niedriger ist als der Mittelwert der Points, die eine Molkerei bei der Handelswertbestimmung 1922 erzielt hat, wird als Qualitätsprämie 1 Markka pro Fass bezahlt mit einer Erhöhung um 25 Penni für jeden beginnenden 0.3 Point, wobei jedoch die höchste Prämie 1 Markka 75 Penni pro Fass beträgt.

Sind also die mittleren Points der Molkereien A, B, C, und D bei der Handelswertbestimmung von 1922, 11.84, 11.47, 11.32, und 10.98 beziehungsweise, so wird ihnen eine Qualitätsbelohnung für das Jahr 1923 von den Points 11.3, 11.0, 10.7 und 10.3 an bezahlt.

Ausser den obenerwähnten Qualitätsprämien werden den Bereitern feiner Sauerbutter (die bei der Handelswertbestimmung mindestens 11.3 Points erzielt hat) als ausserordentliche Prämie 50 Penni pro Fass gewährt.

In folgenden Fällen wird jedoch keine Qualitätsprämie gezahlt:

(*a*) Wenn die durchschnittliche Pointzahl bei der Handelswertbestimmung von 1923 in Milchmolkereien unter 10.7 oder in Rahmmolkereien unter 9.0 ist. Zu den letzteren werden alle Molkereien gerechnet, die mehr als die Hälfte ihres Rohmaterials (entsprechend Kg. Fett) in Form von Rahm erhalten.

(*b*) Wenn der Wassergehalt der Butter 16 Prozent übersteigt.

(*c*) Für eine Wochenlieferung, bei der auch nur in einem Fass im Exporthafen am Tage des Eintreffens der Butter Schimmel festgestellt wird.

Ausser Valio gewähren auch die Genossenschaftsmolkereien selbst ihren Butterbereitern eine Qualitätsprämie neben ihrem gewöhnlichen

Monatsgehalt.[1] Die Grundsätze, nach denen dieselbe ausbezahlt wird, sind in den einzelnen Genossenschaftsmolkereien verschieden. In den letzten Zeiten kommen die Sätze für die Zahlung der Qualitätsprämien am meisten in Aufnahme:

Ein Markka pro Zentner bei dem Point 11.0 und einem Wassergehalt von 14–15, aber nicht über 16 Prozent.

Zwei Markka pro Zentner bei dem Point 11.3–11.7 und einem Wassergehalt von 14–15, aber nicht über 16 Prozent.

Drei Markka pro Zentner bei dem Point 11.3–11.7 und einem Wassergehalt von 15–16, aber nicht über 16 Prozent.

Vier Markka pro Zentner bei dem Point 12 oder mehr und einen Wassergehalt von 14–15, aber nicht über 16 Prozent.

Fünf Markka pro Zentner bei dem Point 12 oder mehr und einem Wassergehalt von 15–16, aber nicht über 16 Prozent.

II. QUALITÄTSBEZAHLUNG UND QUALITÄTSBELOHNUNG IN DEN KÄSEREIEN.

Emmenthalerkäse wird in Finnland bereits seit etwa 60 Jahren hergestellt, doch hat seine Produktion bis 1914 in den Händen eingewanderter schweizer Molkereipächter oder -besitzer gelegen. Diese verkauften ihre Erzeugnisse hauptsächlich nach Russland und die schlechteren Qualitäten in Finnland. Eine staatliche Kontrolle bestand für Käse in Finnland nicht und ist auch heute noch nicht vorhanden. Die Qualität des exportierten Käses war infolgedessen sehr ungleichmässig. Im Jahre 1913 tat Valio Schritte für die Hebung der Käseproduktion in den Genossenschaftsmolkereien, die bis dahin überhaupt keinen Käse hergestellt hatten, indem die Firma bei zweien ihrer Mitgliedermolkereien Praktikantenanstalt für die Ausbildung von Emmenthalerkäsern einrichtete. In dem Masse, wie einheimische Käser die Praktikantenanstalten absolvierten, gingen auch die Genossenchaftsmolkereien zur Käseproduktion über, sodass heute über 50 Genossenschaftskäsereien im Lande existieren. Manche von diesen Käsereien haben eine bedeutende Grösse und sind mit 6 bis 8 Kesseln ausgestattet.

Die Abrechnung mit den Molkereien.—Bei der Abrechnung mit seinen Mitgliedermolkereien über die Käse hat Valio von Anfang an die Qualitätsbezahlung befolgt. Wenn die Käse aus den Molkereien in dem Zentrallager der Firma zu Helsingfors eingetroffen sind, wird ihre Prüfung von einer dreiköpfigen Kommission ausgeführt, die aus sachkundigen Funktionären der Firma zusammengesetzt ist. Bei der Prüfung werden berücksichtigt: die Lochbildung, die Konsistenz, der Geschmack, der Geruch, die Oberfläche und das Aussehen. Der Fettgehalt wird im eigenen Laboratorium der Firma untersucht. Auf Grund der Prüfung werden die Käse in vier Klassen geteilt, in deren zwei höchste die Exportkäse gehören. Die erste Klasse umfasst die feinsten und die zweite die gewöhnlichen Exportkäse. Die Käse der niederen Klassen werden nur ausnahmsweise aus dem Lande ausgeführt. Der Unterschied in den Preisen, die den Molkereien für die Käse der verschiedenen Qualitätsklassen bezahlt worden sind, schwanken je nach dem allgemeinen Preisniveau und entsprechend der Nachfrage nach schlechteren Käsesorten. Gewöhnlich beträgt die Preisdifferenz zwischen zwei aufeinanderfolgenden Qualitätsklassen 15 bis 20 Prozent. Ist die Nachfrage nach der feinsten Käsesorte rege, die nach dem zweitklassigen Käse dagegen flau, so kann der Preisunterschied sogar 25 Prozent betragen. Für Käse derselben Qualitätsklasse berechnet Valio jedoch immer denselben Preis.

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[1] In den finnländischen Genossenschaftsmolkereien wird das Personal von der Genossenschaft, nicht von dem Inspektor abgelohnt.

Da in den Genossenschaftsmolkereien erst seit zehn Jahren Käseproduktion getrieben wird, hat sich Valio auf dem Gebiet des Käsehandels noch nicht die einflussreiche Stellung errungen wie auf dem Buttermarkt. Aus diesem Grunde ist in Finnland auch die Qualitätsbezahlung bei der Käseabrechnung nicht so gewöhnlich wie bei der Butterabrechnung. Im Hinblick darauf, dass Valio bei der Anwendung der Qualitätsbezahlung gut mit den privaten Käsefirmen zu konkurrieren vermocht und sich auch schon auf diesem Gebiet zu einem führenden Geschäft entwickelt hat, wird es aber wahrscheinlich nicht lange dauern, bis die Qualitätsbezahlung auch bei der Käseabrechnung vollständig durchgedrungen ist.

Die Qualitätsbelohnung der Käser.—Wie den Butterbereitern zahlt Valio auch den Käsern Qualitätsprämien aus. Von Anfang 1921 bis Ende 1922 hat die Firma den Käsern 2 Markka pro Laib (Gewicht 80 bis 100 Kg.) entrichtet, der bei der von Valio ausgeführten Prüfung in die höchste Klasse fiel. Seit Anfang 1923 erhalten die Käser von Valio 3 Markka pro Laib von jedem Käse der I. Klasse und Markka 1.50 pro Laib von jedem Käse der II. Klasse. Den 10 Molkereien, von deren Käsen bei der Prüfung der Firma im Lauf des Jahres die grösste Prozentmenge erstklassig ist, wird eine besondere ehrenvolle Erwähnung erteilt. Die Käser derjenigen Molkereien, die drei Jahre nacheinander diese ehrenvolle Erwähnung bekommen, erhalten eine Gratifikation in Bar und ein Diplom. Für die am besten gepflegten Käse werden an die Käsesalzer sechs Anerkennungspreise ausgeteilt.

Ausserdem zahlen auch die betreffenden Molkereien ihren Käsern neben dem gewöhnlichen Monatsgehalt eine Qualitätsprämie für die Käse, die bei der Prüfung durch Valio in die I. Klasse kommen. Die Höhe der Premie variiert in den verschiedenen Molkereien einigermassen, doch scheint es in grösserem Umfang üblich zu werden, dass dem Käser als Qualitätsbelohnung der Preis eines Kilogramms Käse für jeden Laib I. Klasse entrichtet wird.

III. DIE QUALITÄTSBERECHNUNG BEI DER LIQUIDIERUNG DES ROHMATERIALS.

Die Abrechnung über die Molkereiprodukte nach Massgabe der Qualität schien jedoch nicht effektiv genug zu sein, um die Qualität der Erzeugnisse zu verbessern. Sie wirkte zwar auf die Angestellten der Molkereien, aber die Viehbesitzer wurden grossenteils schon nicht mehr davon betroffen. Man musste also das Uebel selbst, das heisst, die Misstände bei der Behandlung und Pflege des Rohmaterials im eigenen Heim der Viehbesitzer, an der Wurzel fassen. Zu diesem Zweck wurde zunächst eine nachdrücklichere Aufklärung in die Wege geleitet. In den Jahren 1912 und 1913 veranstalteten die Molkereiverbände im ganzen Lande unter anderem zahlreiche Kurse über die Behandlung der Milch und Rahm für die Mitglieder der Genossenschaftsmolkereien. Alles dies erwies sich jedoch als unzureichend.

Im Jahre 1912 wurde der erste Milchkontrollverein gegründet, dem neun Molkereien beitraten und der den Zweck verfolgte, durch Anstellung eines fachkundigen Milchprüfers die Prüfung und Klassifikation der den Mitgliedermolkereien des Vereins gelieferten Milch mit Hilfe von Gärungsreduktasproben und mit den Sinnesorganen anzuordnen und Stallinspektionen auszuführen, zur Beseitigung der Qualitätsmängel der Milch anzuleiten, die Einführung der Qualitätsbezahlung in den Molkereien zu befördern und so weiter. Es war geplant, derartige Vereine in den Kreisen aller Molkereiverbände und so zahlreich zu schaffen, das ihnen die Molkereien allgemein hätten angehören können. Die Gründung von Milchkontrollvereinen machte jedoch sehr langsame Fortschritte, und nach dem Ausbruch des Weltkriegs 1914 geriet sie vollständig ins Stocken. Während des Krieges waren die Anforderungen an die Qualität der Molkereiprodukte keine grossen, weshalb auch die ganze Arbeit zu Gunsten der Verbesserung der Qualität des Rohmaterials ergebnislos war. Im Jahre 1920 konnte schliesslich wieder ein geregelter Butterexport aus Finnland in Gang gebracht werden. Die Qualität der Buttter, die sich während des Krieges in hohem Grade verschlechtert hatte, musste jetzt schnell wieder gehoben werden. Da die Aemter der Molkereikonsulenten durch Beschluss des Reichstags 1919 eingezogen worden waren, wurde 1920 die Instruktionsabteilung der Firma Valio gegründet; als Beamte derselben wurden für die verschiedenen Molkereiverbände[2] acht Instrukteure eingesetzt, die nach den Direktiven und mit Unterstützung der Instruktionsabteilung für die Angestellten der Molkereien praktische und theoretische Kurse über milchwirtschaftliche Spezialfragen anordnen. Diese Instrukteure erhielten zur Spezialaufgabe, die Angestellten der Molkereien in die Ausfürung der Gärungsreduktasproben sowie in die Prüfung und Klassifikation der Milch einzuweihen. Zugleich lag es ihnen auch ob, den Mitgliedern der Genossenschaftsmolkerein die Vorteile der Qualitätsbezahlung auseinanderzusetzen.

So wurde denn im Jahre 1921 die Qualitätsbezahlung in 66 Molkereien eingeführt; 1922 war sie in 123 in Gebrauch, und heute finden wir sie in wenigstens 150 Molkereien. Da es in Finnland nur 225 Molkereien gibt, die regelmässig Exportbutter herstellen, ist das bisherige Resultat verhältnismässig bedeutend, zumal da alle grössten Molkereien bereits die Qualitätsbezahlung anwenden. In gewissen Molkereiverbänden bedienen sich ihrer schon 90 prozent aller Molkereien, und es wird nicht lange dauern, bis sie von allen Milchmolkereien des Landes eingeführt ist. In den Rahmmolkereien ist in dieser Hinsicht kein so schneller Fortschritt zu verzeichnen.

In den Milchmolkereien dient als Grundlage der Prüfung die Gärungsreduktasprobe, und die Klassifikation der Milch erfolgt hier nach der Tabelle von Prof. Orla Jensen. Qualitätsproben werden zwei- oder dreimal in Monat angestellt. Der Grundpreis der Milch wird in der Weise bestimmt, dass das monatliche mittlere Fettprozent aller in die Molkerei gelangten Milch berechnet und die zu verrechnende Geldsumme durch die Zahl der während desselben Monats empfangenen Kilogramme Milch dividiert wird. So findet man den mittleren Preis der in die höchste Qualitätsklasse gehörigen Milch von mittlerem Fettgehalt. Auf Grund dieses Ausgangspreises wird dann der an die betreffenden Lieferanten zu zahlende Preis nach Massgabe des Fettgehalts und der Qualität der Milch festgestellt. Gehört die Milch der höchsten Qualitätsklasse an, so wird dafür nach dem Fetgehalt bezahlt. Von dem Preis der in die niederen Qualitätsklassen fallenden Milch wird ein Betrag pro Qualitätsklasse abgezogen. Der Preisunterschied zwischen der erst- und zweitklassigen Milch ist zurzeit 5 Penni pro Kilogramm, während der Fettgehalt gleichgross ist.

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[2] In Finnland bestehen im ganzen zehn Molkereiverbände.

In der Rahmmolkerei erfolgt die Prüfung vorläufig hauptsächlich mit Hilfe der Sinnesorgane. Die Sahne wird bei der Prüfung in drei Klassen eingeteilt. Die Sahne der I. und II. Klasse wird in der Molkerei entgegengenommen, die der III. Klasse wird an den Lieferanten zurückgeschickt. Die Sahne beider Klassen wird getrennt gebuttert, und die daraus gewonnene Butter wird unter verschiedenen Marken verkauft. Bei der Abrechnung über die Sahne wird der den Mitgliedern zu zahlende Preis des Kilogramms Fett nach dem Erlös bezahlt, der beim Verkauf der Butter aus der Sahne beider Klassen erzielt worden ist. In manchen Molkereien wird den Lieferanten schlechterer Sahne für dass Fett nicht einmal ein so hoher Preis gezahlt, wie ihn der Preis der Butter, die aus ihrer Sahne zubereitet worden ist, voraussetzen würde, sondern für schlechtere Sahne wird 15 bis 20 prozent weniger pro Kilogramm Fett angerechnet. In letzter Zeit hat man jedoch auch in den Rahmmolkereien damit begonnen, neben der Prüfung mittels der Sinnesorgane teilweise auch die Reduktasprobe als Prüfungsgrundlage anzuwenden und die Sahnearten nach Orla Jensen zu klassifizieren.

IV. DIE QUALITÄTSBEZAHLUNG IM MILCHHANDEL DER STÄDTE.

Der Fettgehalt und die hygienischen Eigenschaften der nach Helsingfors und den anderen grössten Konsumszentren gelangenden Milch sind bis zum Jahre 1916 überhaupt kaum beachtet worden. Erst als Valio in dem genannten Jahre neben seinem übrigen Geschäftsbetrieb auch den Milchhandel in sein Programm aufnahm, stellte sich die Firma zugleich auch die Aufgabe, auf die Verbesserung der Qualität der direkt zu Konsum verbrauchten Milch hinzuarbeiten. Es dauerte jedoch mehrere Jahre, bis daran gedacht werden konnte, die Milch nach ihrem Fettgehalt zu verrechnen, und erst Anfang 1922 konnte Valio bei der Abrechnung über die Konsummilch die vollständige Qualitätsbezahlung einführen. Gegenwärtig wird alle an die Haupt- und Zweiggeschäfte der Firma gelieferte Konsummilch auf Grund von Gärungsreduktasproben geprüft und nach Orla Jensen in vier Klassen abgestuft. Der Preis der Milch wird auf diesselbe Weise wie in den Genossenschaftsmolkereien bestimmt. Der Preisunterschied zwischen den verschiedenen Qualitätsklassen wird jedesmal getrennt festgestellt, und seine Höhe beruht teils auf dem allgemeinen Preisniveau—in Finnland schwankt der Preis der Konsummilch in den verschiedenen Jahreszeiten verhältnismässig stark—teils auf dem gegenseitigen Mengenverhältnis der schlechten und guten Milchsorten. Sind schlechte Milchqualitäten im Vergleich zu den guten relativ viel vertreten, so ist der Preisunterschied zwischen den einzelnen Qualitätsklassen ziemlich gross, während bei gleichmässiger Qualität der Milch ein verhältnismässig geringer Preisunterschied in Anwendung kommt.

V. DIE EINWIRKUNG DER QUALITÄTSBEZAHLUNG UND DER QUALITÄTSBELOHNUNG AUF DIE QUALITÄT DER ERZEUGNISSE.

Alle oben geschilderten Massnahmen haben die Verbesserung der Qualität des Rohmaterials und der Erzeugnisse in den finnländischen Genossenschaftsmolkerein erheblich befördert, zumal da gleichzeitig auch in den Molkereien und unter den Viehbesitzern eine effektive Aufklärungstätigkeit eingesetzt hat.

Von der Exportbutter Finnlands waren im Jahre 1913 nur 58.7 Prozent erstklassig. Im folgenden Jahr stieg die Menge der erstklassigen Butter auf 60.5 Prozent. In den Kriegsjahren 1915–19 dagegen sank die Qualität der finnländischen Butter bedeutend unter das Niveau von 1913. Im Jahre 1921 konnte jedoch bereits die Menge der erstklassigen Butter auf 65.7 Prozent erhöht werden und die entsprechende Prozentzahl für 1922 beträgt wahrscheinlich etwa 80 Prozent—die Statistik liegt noch nicht fertig vor—wenigstens in bezug auf die Molkereien von Valio. Ausserdem ist die Qualität der Primabutter stabiler als je vorher geworden, denn die Molkereien haben ihre Qualitätsmarken im allgemeinen viel besser als früher beibehalten können.

Die Qualität des Käses hat sich ebenfalls bedeutend verbessert. Die höchste Klasse wurde 1922 von fast der Hälfte sämtlicher an Valio gelieferten Käse erreicht. Etwa 85 Prozent von allen an Valio gesandten Käsen waren Exportkäse, sodass nur ungefähr 15 Prozent von der Produktion der Käsereien der Firma minderwertige Ware darstellten. In früheren Jahren belief sich die Produktion exportuntauglichen Käses in den Molkereien von Valio auf etwa 35 bis 40 Prozent.

Wie bei der Butter und dem Käse hat sich die Qualität auch für die nach den Konsumszentren gelangende Milch in letzter Zeit wesentlich verbessert. Die in die beiden untersten Qualitätsklassen fallende Milch ist fast ganz verschwunden, und auch zweitklassige Milch ist im Winter und Hochsommer sehr wenig. Nämlich nur etwa 30 Prozent von der gesamten Milchmenge vorhanden. Beim Uebergang von Winterfütterung zur Grünfütterung und unvorhergesehenem Witterungsumschwung vermehrt sich die zweitklassige Milch um etwa 10 Prozent. Da die Transportstrecken in Finnland sehr gross und die Beförderungsmittel mangelhaft sind, darf das erzielte Resultat gleichwohl als recht befriedigend angesehen werden.

Zufolge der Qualitätsbezahlung sind die Genossenschaftsmolkereien auch allgemein dazu übergangen, Milchprüfer anzustellen, die zugleich auch den Mitgliedern dieser Molkereien bei der Milchpflege mit Ratschlägen an die Hand gehen. Die grössten Molkereien entlohnen den Milchprüfer allein, die kleineren zu je zwei bis vier gemeinschaftlich.

Um die Verbesserung der Qualität ihrer Erzeugnisse weiter zu fördern, veranstalten alle Molkereiverbände in ihrem Kreise jährlich drei Butterausstellungen mit Wanderpreisen und Ehrendiplomen sowie fortlaufende, die ganze Molkereiwirtschaft umfassende Wetterwerbe, bei denen alle Wirtschaftszweige jeder Molkerei nach je zwei Jahren einer gründlichen Beurteilung unterliegen. Für diese Wettbewerbe haben die Molkereiverbände von Valio wertvolle Wanderpreise zum Geschenk erhalten. Für die Anleitung der Käser hat Valio vom Jahre 1916 ab einen besonderen Käsereiinstrukteur angestellt gehabt, der fortgesetzt die Molkereien bereist und auch für alle an Valio gelieferten erstklassigen Käse eine Qualitätspremie bezieht. In den Jahren 1920–21 veranstaltete Valio unter allen seinen Mitgliederkäsereien einen Wettbewerb, bei dem an die besten Käser wertvolle Preise ausgestellt wurden. Gelegentlich dieses Wettbewerbs wurde in jeder Käserei eine gründliche Besichtigung vorgenommen und wurden die betreffenden Funktionäre auf alle dabei zu Tage getretenen Misstände aufmerksam gemacht. Für die Verbesserung der Qualität der Erzeugnisse lässt Valio gleichfalls in seinem Laboratorium Reinkulturen für den Bedarf der Buttermolkereien und Käsereien anfertigen.

Die obenerwähnten Massnahmen für die Hebung der Qualität der Molkereiprodukte haben sich unter finnländischen Verhältnissen als ausserordentlich praktisch erwiesen. Sie haben jedoch zur Voraussetzung, dass die Molkereiwirtschaft des Landes grösstenteils um eine einflussreiche Zentralorganisation zusammengeschlossen ist, die den Verkauf der Produkte beherrscht und durch ihre Autorität auch auf deren Herstellung einwirken kann.

[Abstract.]

QUALITY RATES AND PREMIUMS IN THE FINNISH DAIRY INDUSTRY.

Otto P. Pehkonen, technical director, Valio, Cooperative Butter Export Association, Helsingfors, Finland.

The rise and development of quality premiums in the Finnish dairy industry is contemporaneous with the organization of the cooperative creameries since about 1900. The first price fixation was based on the fat content determined by Gerber's acid process and the payment was made for the milk, according to the fat content in one kilogram of milk, and for the cream per fat kilo. This first step on the part of the cooperative dairies resulted in the founding of the central cooperative association of Valio. This introduced the weekly testing of butter and the payment of quality premiums.

The points judged were taste, smell, color, consistency, and packing, and the scale ranged from 1 (poorest) to 15 (best quality). The butter which rated 10.7 points, or more, was considered first-grade export butter and was paid the highest price. The difference in price between first and second grade export butter has risen to as much as 2 marks per kilo.

In 1913 the Government Butter Control Institute was founded and all officially controlled butter was sent there for examination. This institute followed essentially the criteria established by Valio.

In 1921 Valio began to pay premiums to the butter makers of its associated dairies. The butter maker received a premium for all butter which met certain minimum requirements. This premium, which varied from 75 penni to 1 mark 25 penni, per hundredweight, was based on the quality and composition of the butter, as determined by Government tests.

Beginning with 1923 the distribution of the units of quality rating was changed to permit the division of the creameries into various groups according to their output and as the basis taken for the new rating was the average of the points attained by each creamery during the previous year under the Government tests, a quality premium of 1 mark per firkin, with an increase of 25 penni for each additional 0.3 point up to the highest rate of 1 mark 75 penni for the best quality, was the new compensation.

The cooperative creameries pay their butter makers premiums; a table of ratings commonly followed is incorporated in the text.

Since 1913 Valio and the cooperative creameries have undertaken the manufacture of Emmental cheese and at the present time there are more than 50 cooperative factories in Finland. From the beginning Valio has paid premium for quality based on the texture, consistency, taste, odor, surface and appearance of the cheese. According to their tests the cheeses are divided into four classes, the two highest being export cheese. Ordinarily the price difference between the different classes is 15 to 20 per cent. Since the beginning of 1923 the premium for cheese of the first class is 3 marks per cheese (weighing 80 to 100 kilo.), and for cheese of the second class, 1.50 marks.

The cooperative creameries, members of the Valio Association, pay their cheese makers a premium generally equivalent to the price of a kilogram of cheese.

The author gives an account of the improvement of dairy products by improvement of the raw materials and the conditions under which they are produced through the efficacy of the various agencies, namely, the establishment of milk-control organizations, State legislation, the institution of practical and theoretical courses of study, and the employment of milk testers to cooperate with the various creameries.

The quality premiums on milk are paid in accordance with the fat content based on the fermentation reductase tests and classification according to the tables of Orla Jensen. The cream is handled in the same manner. Since 1916 Valio has applied itself to the improvement of the quality of consumed milk. Since 1922 the milk has been tested and assigned to four classes, which form the basis of the quality rates.

Briefly, the results of the payment of quality rates are as follows:

(1) In 1913 only 58.7 per cent of the export butter was first class, in 1922 about 80 per cent was first class.

(2) The quality of the cheese has improved from about 35 to 40 per cent export cheese in former years to about 85 per cent export cheese in 1922.

(3) Very satisfactory results have also been obtained with consumer's milk inasmuch as the two lower classes have almost completely disappeared.

The establishment of milk testing, as well as the special premiums and other inducements of Valio, have done much to revive the quality of dairy products.

DEFINITION OF PASTEURIZATION BY LAW.

Boke van der Burg, professor, Agricultural College, Wageningen, Holland.

By Pasteurization of milk is meant, generally speaking, all heating up to a temperature below the boiling point and above, about 60° C., to which milk is submitted with a view to decrease the number of bacteria.

Through this operation two different purposes are aimed at, viz: (1) Destroying pathogenic organisms that might exist in the milk, and (2) increasing the keeping qualities of the milk.

The effectiveness of heating depends upon the temperature to which the milk is exposed, and upon the time during which the temperature is held.

According to the method of Pasteurization the following systems may be distinguished:

(*a*) Pasteurization with the application of a high temperature (80° to 90° C., or even somewhat higher), the duration of heating not exceeding, as a rule, three minutes. This procedure, which we may conveniently call the Danish method, is always adopted in the continuous, or flash process.

(*b*) Pasteurization at a comparatively low temperature, from 60° to 65° C. (sometimes higher), during a period of from 20 to 30 minutes. For the latter method several courses of procedure are used; either the continuous process, or the vat or holding system, is adopted.

In the former procedure, the milk, after being heated in a fore-warmer, up to the temperature desired, flows through two or three large tanks or through a system of wide tubes, the dimensions of which—in relation to the quantity of milk to be treated—have been fixed so as to compel the milk to flow slowly and to stay in the tubes during a time that is thought necessary for thorough Pasteurization. The temperature of the milk is kept as constant as possible during that period.

In the holding process a quantity of milk, after being heated up to the temperature required, is gathered in a tank and kept there at said temperature during a period that has been accurately fixed beforehand. The milk does not leave the tank before the time prescribed has elapsed. Of course the milk may be heated, held, and cooled in the same vat.

To the system of holding Pasteurization belongs also the Pasteurization in the final container, a system frequently adopted in Holland. It may be noted that in our country the temperature is usually kept at 68° C., at the least, during half an hour.

Pasteurization of consumers' milk is required both for commercial and hygienic reasons.

For commercial reasons, because it would be impossible to supply the consumers with a sufficient quantity of non-Pasteurized milk in a condition that would allow housekeepers to keep it fresh for any considerable time. This is due, in the first place, to the large extent of the milk-producing area of large cities, which necessitates transportation over great distances; in the second place, to the insufficient care bestowed upon handling the milk in most farms. Even in case the milk should be carefully cooled during transportation and distribution it would be impossible especially in the hot season to prevent large quantities of milk from getting unfit for consumption.

The Pasteurization of milk for consumption is of far greater importance for public health.

Statistics amply show how beneficial an influence Pasteurization has had with regard to lowering the percentage of infant mortality. Well substantiated data in support of this fact are to be found anywhere in literature.

There are numerous instances of the spread of typhoid fever and other contagious diseases whose germs may be transmitted through the consumption of non-Pasteurized milk. It is a fact that the majority of housekeepers seem to be unwilling to realize the great danger for the health of their families which may result from the consumption of raw bulk milk, even though experts seize every opportunity to sound a warning against it.

In connection with the above we must be aware of the fact that the greater part of Pasteurized milk sold to consumers is consumed as such. Most people have not the faintest notion that this milk, too, might be exposed to risks if not heated again before consumption.

Therefore, from the standpoint of public health, it must be considered of the highest importance that measures should be taken to give full guaranty to the consumers that the milk sold as Pasteurized has actually been submitted to operations that would render it perfect from an hygienic point of view.

In the designation "Pasteurized" the public reads a guaranty for the efficiency of the procedure to which the milk has been submitted; they repose a certain confidence in Pasteurized milk, as to its fitness for being consumed as delivered by the milk plants. Hence it is expedient, that the designation "Pasteurized" should not be used indiscriminately for all milk that has been submitted to heating, but that this term should be exclusively reserved for heated milk that has been treated in such a way that it can not imperil the health of the consumer.

Pasteurized milk must be milk that has been heated in such a manner that it may be fairly taken for granted that it contains no living pathogenic germs. Measures must be taken that such milk, after heating, can not again be contaminated with deleterious organisms. After Pasteurization the milk must be refrigerated and kept at so low a temperature that the remaining spores can not develop.

A regulation by law of the sale of Pasteurized milk must enact, in the first place, the prohibition of selling milk by the name of Pasteurized milk, if the seller can not show a license from some competent authority. Such a license can be withdrawn at any time.

A dairy can be granted a license for selling Pasteurized milk only provided it meets certain requirements both as regards building and equipment, and the responsible manager will have to pledge himself in writing to follow the instructions that will be given with regard to the handling of milk in his plant.

It is not my object to give full details as to the conditions that will have to be satisfied previous to granting a license for supplying Pasteurized milk. I shall restrict myself to the essential points and only mark out the main outlines.

(*a.*) *The building.*—The building in which the business is conducted will have to meet sanitary specifications. Therefore certain demands shall be made as to the construction of walls, floors, and ceiling, lighting, ventilation, and premises of the building, and the absence of undesirable works and trades in the environment of the dairy. The building will have to afford ample room for a spacious mounting of the required machinery.

(*b.*) *The mechanical features.*—The machinery required for working the milk will have to be constructed so as to guarantee sanitary handling of the milk. The cleansing and upkeep of the machinery will be under permanent control. The plant will comprise steam boilers of a capacity sufficient to insure a careful sterilization of apparatus and containers.

(*c.*) *The milk.*—For milk to be labeled "Pasteurized," the milk plant under control will have to use, exclusively, such milk as is unadulterated, hygienically produced, and carefully handled; it should be perfectly fresh the moment it is Pasteurized, and its bacteria count must not exceed a fixed norm. The dairy under control will have to make certain, by means of prescribed reactions, that the milk shows no abnormal properties.

The milk that is to be Pasteurized will have to be shipped in well-cleansed vessels and will have to meet certain specifications as to cleanliness.

Pasteurization must always be preceded by mechanical clarification of the milk.

(*d.*) *Pasteurization.*—In connection with the machinery employed, the minimum temperature and the minimum duration must be fixed for every milk plant separately. The period of Pasteurizing must be increased in proportion to the lowering of the temperature.

In Pasteurization according to the Danish method (see above) neither temperature nor period of heating can be accurately regulated. In order to make sure that the pathogenic organisms are actually destroyed, care should be taken that the temperature should always be kept rather too high than too low and that the apparatus should have a large capacity in order to make the average (computed) time of flow as long as possible. In case this method of Pasteurizing should be permitted, it will be necessary to require that milk treated according to this system should show a negative Storch reaction (said reaction to be executed at room temperature during an observation period of five minutes, at the least).

In Pasteurizing at low temperature by the continuous or flash method (the milk flowing uninterruptedly through the "holder" or "retarder") we are able to regulate the temperature pretty accurately, but, on the other hand, we can not definitely fix the proper period of heating. It could only be done in case there was no mixing up in the apparatus of milk entering first and milk flowing in at a later period. However, this mixing can not be prevented in any apparatus of the continuous process. Therefore, the computed average flowing period is not identical with the exact heating period; so it will also be found necessary in this case to require a wide margin of safety. It will be desirable, before putting an apparatus into use, to examine the extent to which the milk that flows into the apparatus in successive intervals is mixed.

The absolute or positive "holding" process is preferable to the others inasmuch as it allows us to regulate both temperature and time with great accuracy.

The most commendable equipment is that which works quite automatically, inasmuch as it will prevent such errors as, for instance, the untimely opening and shutting of taps by attendants.

Care must be taken that all the taps should fit perfectly, lest there should be a mixture of Pasteurized milk with that which is not sufficiently heated.

The different investigators are not of one mind concerning the temperature at which milk should be Pasteurized in order to make sure that the pathogenic organisms are destroyed. It is, however, pretty generally admitted that heating up to 61° C. during 20 minutes will be effective, provided the milk is kept moving during the heating period, and provided the formation of foam or membranes is avoided.

As for temperature, practice has fixed certain limits in the countries where the public positively requires such milk as will cream in a normal way. In fact, a heating above 63° C. will reduce the creaming ability of milk. Seeing that a certain allowance must be made for temperature, say from 1 to 1½° C., one is likely to fix the lowest limit somewhat below 63° C., say, at 61½ or 62° C., and to fix the minimum duration at 30 minutes.

Several American States have issued conformable regulations.

(*e*) *Control of Pasteurization.*—Dairies wishing to bring Pasteurized milk upon the market will have to fit their apparatus with self-registering thermometers (thermographs, "recorders"), which are to be sealed up during the time of Pasteurization. The dated and certified registrations are to be kept for inspection.

The officials, having charge of the inspection, will have to be admitted to the dairy at any time and, on demand, they are to be furnished with all data relative to the technical part of the business; they are empowered to take milk samples necessary for inspection and to collect all data they might think expedient for efficient verification.

(*f*) *The handling of Pasteurized milk.*—Pasteurized milk must be transported and distributed in closed vessels exclusively so as to render it impossible to open the container without breaking up a seal or label.

This measure is necessary for preventing Pasteurized milk from being contaminated or polluted during distribution.

In the case of milk which is sold in the street or in a shop from out a can or a vat, the risk of its being contaminated is so great that such milk can not be allowed to be delivered as Pasteurized milk, even in case it should be drawn by means of a tap.

The container will have to bear the date of the day on which the milk was Pasteurized.

(*g*) *Cooling the Pasteurized milk.*—After Pasteurization, the milk will have to be thoroughly cooled and kept at low temperature. At the time of delivery the temperature must not exceed 8° C.

(*h*) *Staff of the dairy.*—The staff of the dairy, so far as they handle the milk or the utensils in any way whatever, will have to be placed under medical control.

(*i*) *Control of Pasteurized milk.*—At any time Pasteurized milk will have to meet certain bacteriological requirements, to be stipulated later on. Among others, one might insist that the investigation as to coli-bacteria count must yield a negative result. This, again, is a question of details that can be further elaborated after the main principles will have been laid down in their general outlines.

CERTIFIED MILK.

Wilson H. Lee, president, Certified Milk Producers' Association, New Haven, Conn.

Certified milk is clean, unprocessed milk of uniform composition from healthy cows, and carefully guarded against disease or contamination. Dr. M. J. Rosenau says:

> It represents one of those high ideals which at first seems visionary and unattainable, but is, in reality, an accomplished fact.

In 1891, Dr. Henry Leber Coit, of Newark, N. J., conceived the idea of having a representative commission of physicians establish correct clinical standards of purity for milk, and undertake the control and supervision of the dairy farm producing it; and when all requirements were fully met, to certify to the high quality of the product. Mr. Stephen Francisco, of Montclair, N. J., who was at that time producing a high-grade milk on his Fairfield dairy farm, volunteered to place that farm and its little herd of 13 cows under the proposed commission. In April, 1893, physicians of Newark, Orange, and Montclair, N. J., joined Doctor Coit in incorporating the Medical Milk Commission of Essex County, N. J. Standards, rules, and regulations were formulated, and a contract was made with Mr. Francisco. This initial effort was so successful that Mr. Francisco soon had to increase his herd—it now contains about 1,000 cows—and certified milk became an established fact.

The term "certified milk" originated with Doctor Coit, and with the approval of the Essex County Milk Commission it was registered by Mr. Francisco in the United States Patent Office in 1904. This was done solely to protect the term against possible abuse, and with the definite understanding that any properly qualified medical milk commission should be free to use it.

Between 1891 and 1896, 11 other medical milk commissions were formed in different parts of the country, and of course as many different certified-milk farms developed. Little progress was made, however, until after the organization of the American Association of Medical Milk Commissions in 1907, and of the Certified Milk Producers' Association of America the year following.

The medical milk commissions did not always appreciate the difficulties and problems of the producers; and except for the general desire to secure a milk of the highest quality there was too often a distinct absence of the sympathetic and helpful cooperation that the producer felt was his due. As a consequence the associations grew apart rather than together. However, as is usually the case, when each understood the other's point of view better feeling began to develop. Then followed joint meetings wherein the good faith and even the intelligence of the producers received recognition. This mutual understanding grew stronger, as did the realization that neither organization could function without the other, and that the interests of both could best be served by establishing one national headquarters. This was accomplished last year when Dr. Ralph R. Ferguson consented to accept election as executive secretary of both the medical and producers' associations. More than 100 per cent increase of members in both organizations shows the well-deserved appreciation of Doctor Ferguson's efficiency.

Practically all medical milk commissions are appointed by a county or State medical society, although there are a few such commissions that have been created in other ways, notably the one that supervises the Walker-Gordon laboratories and farms.

Many States now recognize and protect certified milk by statute, and in at least one State the law requires that the standards approved by the American Association of Medical Milk Commissions and the Certified Milk Producers' Association of America shall be complied with in the production of milk before it may be labeled "certified."

In 1912 the American Association of Medical Milk Commissions first published The Methods and Standards for the Production and Distribution of Certified Milk. While there have been no fundamental alterations in the content, some changes have been found desirable, and these have been made in the recently approved revision.[1]

The certified-milk movement is unquestionably the outstanding effort and the only nation-wide one organized to secure and maintain the production of the highest possible quality of milk; but we should not forget that to no one man, organization, or even country belongs all the credit for the advances that have been made in the production of pure milk. Primarily we are indebted to the scientists, but their work would still be merely interesting scientific knowledge without practical results had not the altruistic spirit of Mr. Francisco been shared by other producers who were encouraged by the medical profession to apply this knowledge. An outstanding example of this is the work of George Ede Gordon, who with the scientific cooperation of Dr. Thomas Morgan Rotch, developed the Walker-Gordon Laboratories and their farms for the percentage feeding of infants and invalids under physicians' prescriptions. It is to Mr. Gordon that we are indebted for many of the practical methods in use to-day in the production of clean milk, among them the use of steam for sterilizing all dairy utensils and putting into use Doctor Freeman's idea of a covered milking pail.

No objection has been raised to the use of any of the different dairy breeds for the production of certified milk; but the prime requisite being perfect health and condition, many producers prefer to use good grades, not because the grade is more resistant to disease, as many suppose, but simply because it is less expensive to discard a grade than a registered purebred cow.

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[1] Copies of the revised Methods and Standards for the Production and Distribution of Certified Milk may be obtained from R. R. Ferguson, M. D., secretary, 4175 Irving Park Boulevard, Chicago, Ill.

Roughly speaking, the retail price of certified milk should be about two and one-half times that of good commercial milk; but its actual cost is like its content of the so-called vitamins. All know that both are in the milk, but the measurement of neither has yet been reduced to an exact and practical operation. An internationally recognized authority on cost accounting recently stated that it had taken him five years to develop a system by which he could get the actual cost of producing a quart of certified milk on his own farm; and added that his form of accounting is still quite too intricate for general use. However, he and several other expert accountants, who are themselves producing certified milk, are now endeavoring to work out a system of accounting suitable for use on the various farms, and so enable producers to study their comparative costs. In view of the fact that few, if any, of the producers know just what certified milk is costing them, it is interesting to find that the price to the consumer varies within the narrow range of 22 to 25 cents per quart in the different cities of the United States.

Among some not well informed there seems to be the impression that certified milk means raw milk versus Pasteurized milk, but certified milk is not in opposition to anything except depriving the human race and especially the helpless infant of the best that science and literally unceasing care can supply. Every form in which milk products are prepared for human food have their proper sphere and probably give the world a better food in that form for less money than can be had from any other source. Pasteurization has undoubtedly accomplished more for the dairy industry, and therefore for mankind, than any other one thing that has been developed in connection with milk in recent years; and it is the only known way by which the great cities of the world can have a practically safe and ample supply of this cheapest and best of foods. Moreover, when it is known beyond peradventure that Pasteurizing does not unfavorably modify any of the now known or still to be discovered attributes of milk, then by all means add this precaution to certified milk.

Valuable as are the various processes that have been developed for the preparation of milk and its products for human consumption, can we reasonably expect from such sources any real progress toward the ideal milk? Would not the prospect look brighter if the scientist could tell us how to feed the cow so that her milk will contain in proper proportion the various so-called vitamins just as we now feed to supply her with the necessary fats, proteins, and carbohydrates?

We believe certified milk is good now, but could it not be made of far more value, especially to infants and invalids if we knew more of the possibilities of developing the so-called antibodies in milk through the cow? We know that the milk of a vaccinated cow will distinctly raise a calf's resistance to tuberculosis. Is it unreasonable to hope that special milk can be produced that will be of real preventive if not curative value to humans?

For the young infant, where the mother can not supply the proper foods, a most promising field for investigation would seem to be the comparative effect of feeding the milk of fresh nonpregnant young cows and that of cows more or less advance in pregnancy. Of course, with this would naturally go a careful study of the chemical and other changes in cow's milk caused by the development of the foetus.

Such questions may to some seem a bit visionary—perhaps they are—but it is from just such men as are here assembled that the answers to seemingly far less hopeful dreams have come. It may be proper to add that while there seems to be no record of any work on the comparative value of milk of fresh and pregnant cows in feeding young infants, no less an authority than Gov. W. D. Hoard claimed that he had been most successful in feeding babies on the milk of young fresh Guernsey cows and, moreover, that the large fat globules for which the Guersney is noted had not caused digestive troubles.

Answers to these and other unknown possibilities of milk are contributions we may properly ask of the milk specialist and nutritional expert, but do not think they are the only scientists whose help is needed. In fact the producer of certified milk is obliged to consult specialists in every branch of modern science to keep his plant in successful operation 365 days in the year, and if the present and very proper urge for short hours continues, he may even have to study hypnotism to enable him to hold men of reasonable intelligence on a job that can not recognize either Sundays or holidays.

There are now 68 medical milk commissions supervising the work of 176 farms, with a daily production of approximately 140,000 quarts of certified milk. This is but a very small fraction of this multibillion dollar industry based on the dairy cow of America. Its most enthusiastic adherents can not claim that it is ever likely to become a serious competitor in the general milk market; but it has in the past, and can continue to exert an influence out of all proportion to its money value so long as we have a Van Norman to assemble for our enlightenment the ablest and best minds of the entire dairy world.

Reasonable profit to the producer must of course receive consideration, but how best to apply the world's knowledge in the betterment of the product must ever be the dominant thought of the leaders of certified milk.

SESSION 12. INSTRUCTION IN DAIRYING IN EDUCATIONAL INSTITUTIONS.

Honorary chairman, Dr. Haakon Isaachsen, professor of animal nutrition, Royal Agricultural College, Norway.

Chairman, Dr. R. A. Pearson, president, Iowa State College of Agriculture and Mechanic Arts.

Secretary, H. P. Davis, chairman, department of dairy husbandry, University of Nebraska.

Y. M. C. A. Assembly Hall,
Syracuse, N. Y., Saturday, October 6, 1923—9.30 a. m.

Chairman Pearson. We will now open session No. 12, upon instruction in dairying in educational institutions. I can not help but feel that this is one of the most important of all the subjects assigned to the several sections. A number of them are most important, like each of the three legs of a three-legged stool. The stool would not stand if any one leg were taken away, and certainly this subject may be ranked as of equal importance with one of the legs of a three-legged stool.

I am pleased to say to you that the honorary chairman, Dr. Haakon Isaachsen, the professor of animal nutrition of the Royal Agricultural College in Norway is with us and occupies a seat upon the platform. [Applause.]

We have a long program. The papers have been prepared by men who are distinguished in their several lines of activity. The audience to-day does not represent in any sense the number of people who are to have the benefit of the papers that will be presented here, and this is a formal session; we who are present are fortunate that we will be permitted to hear these papers at the time of their first presentation and may take part in the discussion of the papers in so far as time will permit, but beyond this room there are many thousands of people in all of the dairy countries of the world who will have the advantage of reading these papers as soon as the publication can be cared for. So we may feel that we are addressing a vast audience although a comparatively few are present in the room at this moment.

The chairman of the program committee, Doctor Rogers, who left the room only a few minutes ago to visit another one of the sessions, has informed me that we may proceed with the program exactly as it is published, with but one or two exceptions.

I hope there will be opportunity for a brief discussion, if you desire, after each paper. We may find it necessary, in order to complete our program, to limit these discussions until the close of the session and then, after having heard all of the papers that may be presented through their authors or through one substitute who will appear in place of the author, we will be free to discuss as long as this session continues, up until 1 o'clock.

The first paper refers to the status of dairy education in England and Wales. It certainly is appropriate that we should start with a paper referring to dairy education in one of the countries where it has been longest available to the dairy interests and where it now is so well developed.

This paper will be presented by Mr. V. E. Wilkins of the intelligence department of the Ministry of Agriculture and Fisheries of England. Mr. Wilkins.

(Mr. Wilkins was not present.)

Chairman PEARSON. Evidently Mr. Wilkins has been delayed. We will proceed, then, to the next paper, and if you wish to give Mr. Wilkins an opportunity to present his paper a little out of turn, later, we will make that arrangement.

The next paper on a similar subject, coming from one of the great dairy countries of the world, where dairying is intensely and highly developed, discusses the education of farmers and dairymen in Switzerland, by Mr. A. Peter, director of the Government Dairy School, Rütti-Zollikofen, Switzerland. Mr. Peter. [Applause.]

DIE AUSBILDUNG DER LANDWIRTE UND MOLKEREIBEFLISSENEN IN DER SCHWEIZ.

ALBIN PETER, Direktor, Molkereischule, Rütti-Zollikofen, Switzerland.

ALLGEMEINES.

Die Schweiz gehört zu den Ländern mit obligatorischer Volksschule (Primärschule), welche 9 Schuljahre (vom 6. bis 15. Altersjahr) umfasst. Sie besitzt sodann zahlreiche weitere Bildungsstätten, welche zum Teil einer weiteren allgemeinen Ausbildung der Volksgenossen dienen, teils aber die besondere berufliche Ausbildung ihrer Schüler zu pflegen haben.

Wir nennen: (1) Die Sekundärschulen, welche in allen grösseren Gemeinden bestehen und den Unterricht in einer zweiten Landessprache, sowie in der unteren Stufe der Mathematik und der Naturwissenschaften vermitteln. (2) Die Schulen der Gymnasialstufe (auch Kantonschulen, höhere Realschulen, Industrieschulen, allgemeine Handelsschulen, und ähnliche). Sie dienen teils zur Vorbereitung auf die Hochschule (Maturitätszeugnis) teils ist ihr Unterricht die Grundlage für nachherige berufliche Ausbildung in der Praxis. (3) Die mittleren Fachschulen, worunter besonders die Techniken (Einzahl: Technikum) die landwirtschaftlichen Mittelschulen und die Molkereischulen zu erwähnen sind. (4) Die Hochschulen: Es bestehen 7 Universitäten (Zürich, Basel, Bern, Fribourg, Lausanne, Genève und Neuchâtel), eine technische Hochschule in Zürich mit Abteilungen für Architekten, Bauingenieure, Maschineningenieure, Ingenieur-Chemiker, Apotheker, Förster, Landwirte und Kulturingenieure, Fachlehrer in Mathematik und Naturwissenschaften, Militärwissenschaftler; ferner eine Handelshochschule in St. Gallen.

Ueber den Umfang, in welchem diese zahlreichen Bildungsstätten benützt werden, sei erwähnt, dass nach einer Zusammenstellung in Reichesberg, Lexikon für Volkswirtschaft, die zum Militär ausgehobenen Schweizer im Alter von 19 bis 20 Jahren, sich im Jahre 1906 über Schulbildung ausgewiesen haben wie folgt: 19,807 hatten die Volksschule (Primärschule) besucht; 4,775 hatten die Sekundärschule

besucht; 1,334 hatten ein Gymnasium besucht; 177 waren an einer Hochschule eingeschrieben.

SPEZIELLES ÜBER DAS LANDWIRTSCHAFTLICHE UNTERRICHTSWESEN.

Die Schweiz zählte im Jahre 1910, 3,753,293 Einwohner von welchen sich 1,040,087 in der Urproduktion (Landwirtschaft, Viehzucht, Gartenbau, Forstwirtschaft, Bergbau) betätigten. Im Jahre 1920 betrug die Wohnbevölkerung 3,880,320 Köpfe, wovon rund eine Million Personen in der Landwirtschaft tätig sein mögen. Auf diese Volkszahl entfallen:

a. *Theoretisch-praktische Ackerbauschulen* mit 2jährigem Unterrichtsgang welcher sich auf Mitarbeit in einem der Schule gehörenden Gutsbetrieb stützt.

	Schülerzahl im Jahre 1921.
Strickhof, Zürich	77
Rütti, Bern	66
Ecône, Wallis	35
Cernier, Neuchâtel	45
	223

b. *Landwirtschaftliche Winterschulen.* Bei diesen ist der Lehrgang vorwiegend theoretisch und wird in zwei aufeinanderfolgenden Winterhalbjahreskursen (November bis Ende März) abgewickelt. Die Schüler stammen alle aus Bauerngütern und kennen die praktischen Arbeiten aus Erfahrung.

Zahl der landwirtschaftlichen Winterschulen im Jahre 1921	27
Schülerzahl der landwirtschaftlichen Winterschulen im Jahre 1921	1, 780

c. *Gartenbauschulen* zur Ausbildung von Gärtnern. Im Jahre 1921 bestanden zwei solcher Schulen (Oeschberg und Châtelaine) die von 61 Schülern besucht waren. Lehrgang ähnlich wie bei den landwirtschaftlichen Schulen.

d. *Molkereischulen und Alpwirtschaftsschulen.* Die Molkereischulen verlangen, das die Schüler beim Eintritt schon mindestens zwei Jahre in einer Käserei oder Molkerei praktisch tätig gewesen seien. Der Lehrgang ist einjährig zur allseitigen Ausbildung im Molkereiwesen, insbesondere betreffend die Milch- und Productenuntersuchung und Betriebskontrolle, ferner werden Halbjahreskurse durchgeführt für Teilnehmer welche schon längere Zeit in Käsereien tätig gewesen sind.

Die Alpwirtschaftsschule hat ein Lehrprogramm für Weidebetrieb und Milchverarbeitung auf den Alpen.

Es bestanden im Jahre 1921:

	Schülerzahl.
Molkereischule Rütti-Zollikofen, Bern	57
Molkereischule Perolles, Fribourg	32
Molkereischule Moudon, Vaud	22
Gesamte Molkereischulen	111
Alpwirtschaftsschule Brienz	30

Die Einrichtung und der Betrieb aller dieser Bildungsstätten stützen sich auf das Bundesgesetz betreffend die Förderung der Landwirtshaft vom Jahre 1893. Nach demselben übernimmt der Bund (die Landesregierung) je 50 Prozent der Auslagen der Kantone für das milch- und landwirtschaftliche Unterrichtswesen. In Betracht kommen somit nur die Ausgaben für Lehrkräfte und Lehrmittel.

Alle Schulen sind mit Internat für die Unterbringung und Verpflegung der Schüler ausgestattet. Der Unterricht ist unentgeltlich, die Schüler haben aber für Kost und Unterkunft je für 6 Monate 350 bis 400 Franken zu entrichten. Die Arbeit, welche die Schüler in der Gutswirtschaft, beziehungsweise Lehrmolkerei leisten, wird nicht vergütet.

Die Lehrer der landwirtschaftlichen Schulen betätigen sich auch an kurzfristigen Kursen (ein bis mehrere Tage) in der Praxis, ferner halten sie Vorträge in den Versammlungen der landwirtschaftlichen Vereine. Auch für diese Veranstaltungen entrichtet der Bund Beiträge. Im Ganzen hat der Bund Beiträge von 50 Prozent bezahlt im Jahre 1921:

Für die landwirtschaftlichen Schulen und Molkereischulen	Fr. 580, 542. 94
Für Kurse und Vorträge	77, 169. 02

DIE LANDWIRTSCHAFTLICHE ABTEILUNG AN DER EIDGENOSSENSCHAFTLICHEN, TECHNISCHEN HOCHSCHULE.

Diese Abteilung wurde im Jahre 1871 eingerichtet und hatte in den ersten Jahren eine bescheidene Frequenz. Das Studium stützt sich auf die Vorbildung, wie sie an einem Gymnasium oder an einer Realschule mit nachfolgender landwirtschaftlicher Mittelschule erworben werden kann. Praktische Vorbildung in der Landwirtschaft oder im Molkereiwesen ist unerlässlich. Der Lehrgang umfasste bis zum Jahre 1911 fünf Semester, seither sechs Semester und schliesst mit der Prüfung zur Erlangung des Diploms als Landwirt E. T. H. Der Lehrgang ist systematisch: in den ersten Semestern erfolgt die Ausbildung in den Naturwissenschaften und in der Mathematik; in den späteren Semestern in den Fachwissenschaften. Molkereitechniker können das Diplom als "Landwirt Richtung Molkereitechnik" erlangen.

Die eidgenossenschaftliche technische Hochschule verleiht auch den Grad "Doktor der technischen Wissenschaften" welcher auch an der landwirtschaftlichen Abteilung erworben werden kann. Gegenwärtig sind an der landwirtschaftlichen Abteilung, 141 Studierende eingeschrieben.

Die diplomierten Landwirte betätigen sich nachher als praktische Landwirte, als Lehrer an den landwirtschaftlichen Schulen oder im Dienste der öffentlichen Verwaltung. Das schweizerische Parlament zählt gegenwärtig 10 diplomierte Landwirte E. T. H. zu seinen Mitgliedern.

DIE LANDWIRTSCHAFTLICHE VERSUCHS- UND UNTERSUCHUNGSANSTALTEN.

Diese sind Sache des Bundes (Landesregierung). Folgendes Verzeichnis orientiert über Namen und Aufwendungen im Jahre 1921:

	Ausgaben im Jahre 1921.
Die Zentralverwaltung und Gutswirtschaft Liebefeld	Fr. 178, 556. 21
Die landwirtschaftliche Versuchsanstalt Oerlikon	302, 614. 88
Die agrikulturchemische Anstalt Liebefeld	208, 448. 83
Die agrikulturchemische Anstalt Lausanne	67, 678. 64
Die Samenuntersuchungs- und Versuchsanstalt Lausanne	92, 357. 06
Die milchwirtschaftliche und bakteriologische Anstalt in Liebefeld-Bern	149, 910. 45
Zusammen	999, 666. 07

Neben diesen Versuchsanstalten allgemein landwirtschaftlicher und milchwirtschaftlicher Richtung bestehen noch zwei besondere Versuchsanstalten, nämlich in Wädensweil für Obst- Wein- und Gartenbau und in Lausanne für Weinbau.

Besonders zu erwähnen sind hier die Arbeiten der milchwirtschaftlichen und bakteriologischen Versuchsanstalt in Liebefeld. Diese wurde im Jahre 1901 eröffnet und es wirkten an ihr die bekannten Forscher Dr. E. von Freudenreich und Dr. Orla-Jensen, jetzt Professor in Kopenhagen. Seit 1907 wird die Versuchsanstalt von Prof. Dr. R. Burri geleitet. Die Autorität Prof. Dr. Burri's in allen Fragen der land- und milchwirtschaftlichen Bakteriologie ist schon längst allgemein anerkannt worden, die bakteriologische Wissenschaft verdankt ihm auch ganz neue Verfahren, wie z. B., das Tuschepunktverfahren, die Burri'schen Röhren u. s. w. Die Erforschung der Milchfehler und der Vorgänge bei der normalen und fehlerhaften Käsereifung hat unter Burri's Leitung gewaltige Fortschritte gemacht, besonders da Burri es verstanden hat sich tüchtige Mitarbeiter, wie Dr. Kürsteiner, Dr. Koestler, Dr. Staub und Dr. Morgenthaler heranzuziehen. Der Tätigkeit des letzteren ist besonders auch eine erfolgreiche Erforschung der Bienenkrankheiten zu verdanken.

Die schweizerische Milchwirtschaft besitzt demnach in der milchwirtschaftlichen Versuchsanstalt Liebefeld eine Forschungsstätte von unschätzbarer Bedeutung und der Unterricht über Milchwirtschaft an den Molkereischulen konnte erst durch Verwendung der Forschungs- und Versuchsergebnisse dieser Anstalt auf eine sichere Grundlage gestellt werden.

Die Schweiz ist ein kleines Land, dem der Schöpfer nur die Gabe der Schönheit verliehen hat. Der Lebensunterhalt muss vom werktätigen Volke in fleissiger Arbeit dem vielgestalteten Boden abgewonnen werden. Damit wir mit den von der Natur reicher bedachten Ländern in Wettbewerb treten können, müssen wir vor allem eine tüchtige berufliche Ausbildung aller Bürger anstreben. Die zahlreichen Bildungsstätten, welche die Schweiz mit grossen Opfern unterhält, sollen aber nicht nur dem eignen Lande dienen, sondern auch eine allgemeine Kulturaufgabe erfüllen und für den Schweizernamen Ehre einlegen. Das sind die Gedanken, die Bundespräsident Motta am Milchwirtschaftlichen Weltkongress 1914 in Bern zum Ausdrucke brachte.

[Abstract.]

THE EDUCATION OF FARMERS AND DAIRYMEN IN SWITZERLAND.

ALBIN PETER, director of the dairy school, Rütti-Zollikofen, Switzerland.

In my communication sent in German I have referred to statistics from secondary institutions in general and after that to the schools of agriculture and dairying.

Switzerland is one of the countries having compulsory primary education and in addition has a relatively high number of secondary schools, colleges, and gymnasia. Seven universities and a polytechnic school afford higher education.

There are four schools of agriculture (theoretical and practical) that train their students in two years and that in 1922 had 223 stu-

dents enrolled. The winter schools of agriculture complete their programs in two courses of five months each. In 1922 these schools numbered 27, with a total enrollment of 1,780 students. The agricultural population of Switzerland consists of about a million people: in view of that fact, the attendance at the agricultural schools might be considered quite satisfactory. The three dairy schools have some 111 students. The higher education of agricultural engineers is undertaken at the national polytechnic school at Zürich; in 1922 the department of agriculture had 141 students. The diploma of agricultural engineer from this institution is given upon the completion of six semesters of work; these graduates make up the faculties of the agricultural schools and the cooperative agricultural classes. Others are active in public affairs; for example, the Swiss Parliament, at the present time, is composed of agricultural graduates.

The Government experiment stations and offices of control number five, not including the dairy and bacteriological station, which deserves special mention.

From this it may be seen how Switzerland provides for agricultural research and education.

Chairman Pearson. Shall we have discussion of this paper at the present time? It occurs to your chairman that several subjects on the program are so nearly alike that you might prefer to continue with the program, hear the papers and then discuss them all together. We would like to act according to your own pleasure in the matter.

Shall we have discussion now on this paper which we have heard, or shall we proceed with the program?

(Upon motion duly made and seconded, it was voted to proceed with the regular program.)

Chairman Pearson. The following three papers, we are informed, have been sent to the officers of the congress, but their authors are not expected to be present. If any author is present, will he kindly let us know: "Dairy instruction in Austria," by Dr. W. Winkler, professor, Agricultural College, Vienna; "Dairy instruction in Norway," by Kr. Støren, professor of dairying, College of Agriculture, Aas, Norway; "Instruction in dairy science in the Agricultural College at Wageningen," by Prof. B. van der Burg, professor of dairy science, Agricultural College at Wageningen, Holland.

The next paper we will have the pleasure of hearing is a paper on "Organized effort to improve dairying in Czechoslovakia," by Dr. Jaroslav Křížlenecký. I need not say that there has been outstanding organized effort to again regulate the affairs of those nations that were put in the worst condition by the war: we have seen it not in one country alone but in several European countries and notably in Czechoslovakia.

This paper was written by Doctor Křížlenecký, chief of the division of animal biology of the Zootechnical Research Institute. By arrangement with the officers of the congress the paper will be read by Doctor Kuráž, secretary, Czechoslovak Legation, Washington, official representative of the Czechoslovak Government. [Applause.]

Dr. Kuráž. Mr. Chairman and gentlemen: The chairman has been kind enough to refer to me as a representative of the Czechoslovak Government. Although I am now in the diplomatic service of the Czechoslovak Republic, I am one of the first graduates of the University of Agriculture at Prague, Czechoslovakia, and my work in Washington is chiefly in agriculture.

If I might be permitted to take this opportunity to add a word, I would like to say that in my official capacity I come in close personal contact with the United States Department of Agriculture. In my opinion, the United States Department of Agriculture is the greatest organization of its kind in the whole world. I think it should be named a United States Department of Service. I feel that this big organization which has done such wonderful work is the chief cause of the high standing of American agriculture.

The same applies to the agricultural experiment stations. Although I have not been fortunate enough to come in close personal contact with the scientific workers, I wish to tell you to-day that our scientific workers in the agricultural subjects keenly appreciate the splendid cooperation which they always receive through our legation from the scientific workers of the United States Department of Agriculture and the agricultural experiment stations.

In each letter which the legation receives I feel the same splendid spirit to help, and I would like to take this opportunity to express to you gentlemen, who represent the American agricultural science, not only my personal appreciation but especially the appreciation of our Ministry of Agriculture and of our whole Government.

I should like to have you know that I feel greatly honored to be permitted to present this paper of my good personal friend to you. If I am not mistaken, it is the first opportunity that anyone has had to present an agricultural paper from Czechoslovakia to a World's Dairy Congress.

(The paper of Doctor Křiženecký was then presented.)

ORGANIZED EFFORT TO IMPROVE DAIRYING IN CZECHOSLOVAKIA.

Jaroslav Křiženecký, D. Sc., in charge of the division of animal biology in the Zootechnical Research Institute, Brno, Czechoslovakia.

The Republic of Czechoslovakia consists of five territorial units: The historical kingdom of Bohemia; the former Margraviate of Moravia, and the former Duchy of Silesia, formerly parts of the Austrian Empire; and the territories of Slovakia and Carpathian Russia, formerly parts of Hungary. The diversity of political conditions, as developed in these countries in the past, produced certain marked differences in the general economy and culture of the several countries, and these differences were to be observed also in agriculture and in the animal industries and their development.

In the former Austrian Empire the three countries of Bohemia, Moravia, and Silesia held the first place as agricultural and likewise as cattle-raising states. Moravia was the home of the Bern-Hanak race of cattle, known far beyond its frontiers, as well as of the Kravar breed, also domiciled in Silesia; in Bohemia, the acclimatized Simmental cattle predominated along the Bohemian Forest, and the mottled cattle of the Bern-Hanak race in the district of Litomysl. Other races, both domestic and foreign, were of secondary importance.

In the early years of the present century dairy control, based on the principles followed in Denmark, was introduced in these three territories of the present Republic of Czechoslovakia. The work was carried on by voluntary associations, with the financial aid and expert advice of the boards of agriculture. The associations grew and prospered until 1914. The World War, however, destroyed all these organizations; all dairy control ceased, and after the war the work had to be done again from the very beginning.

The work of reorganizing and extending dairy control in Czechoslovakia is now in progress. The end in view, however, is not a mere renewal of the control as it existed before the war, but rather the organization of a new dairy control on a broader and firmer basis. Whereas dairy control formerly was largely the private affair of a commune or an association of breeders, under the patronage of the board of agriculture in some cases, it has now been placed on the single basis of Government supervision of the animal industries. The Ministry of Agriculture considers the organization of dairy control as a matter of importance for the whole country; it has provided a foundation for its development and given it a uniform basis for organization.

Uniformity in dairy control in Czechoslovakia is to be achieved through the following measures:

1. The State provides for the education of testers and inspectors.
2. Dairy control is to be carried out according to the same principles in all parts of the country.
3. The State issues identical forms and blanks for the records throughout the Republic.

The organization of this new dairy control has been worked out by a conference called for that purpose by the Ministry of Agriculture. The conference has held three sessions: The first, at the end of 1920; the second in January, and the third in May, of 1921.

Special committees of the conference have prepared detailed regulations for the various phases of dairy control, indicating the basic principles of the new dairy control in Czechoslovakia. Dairy control is now being introduced on the basis of these principles. As I write these lines, the graduates of the spring courses are leaving for their posts as testers and inspectors.

The basic principles for the further development of dairy control in Czechoslovakia, as formulated by the Ministry of Agriculture, will be explained at length in the succeeding paragraphs. The following matters have to be considered:

1. The organization of the courses of study for the testers.
2. The highest and the lowest number of dairy cows to be tested by one inspector, and the periods of testing.
3. The control of milk production and the testing of butterfat content, the period of testing, and the methods of conserving the milk.
4. The preparation of feeding rules, and the computation of balanced rations.
5. The forms of milk records for the testers; the forms of farm and breed records.
6. The equipment of the testers and inspectors.

The greatest emphasis is laid on the proper education of the executive organs of dairy control—the testers or inspectors.

The new method of dairy control in Czechoslovakia differs from the old pre-war method chiefly in this respect, that special testers are now being educated for the service and that they receive a thorough instruction and training.

The testers or inspectors receive their education in special courses at the agricultural colleges at Brno, Prague, and Libwerda; the first two are Czechoslovak, the third, German. About 30 testers have graduated from the courses this year. The courses will be given annually as new testers may be needed.

The instruction given is both theoretical and practical.

1. The theoretical course offers the students a complete theoretical education in dairy control through regular lectures and demonstrations, discussions, written exercises, laboratory work, office work, and the study of the technique of dairy control.

2. The practical course consists of the systematic work of a model dairy control on a model farm with all the necessary labors and calculations. In addition, the students, through excursions combined with the practical application of dairy control, are given the opportunity to study the management of agricultural establishments, both large and small, and practical methods of cattle raising.

Each course lasts three months, the theoretical course preceding the instruction in the practice of dairy control. The theoretical course includes about 430 hours of lectures and 144 hours of exercises. It covers the following subjects:

1. Dairy control, its purpose, aims, and organization.
2. Physiology of the domestic animals.
3. Cattle raising; cattle races.
4. Cattle breeding.
5. The keeping of herd books.
6. The production and care of milk.
7. The chemical composition of milk and its properties.
8. The testing of milk.
9. Feeding stuffs.
10. The feeding of cattle.
11. The computation of balanced rations.
12. The cultivation of fodder plants; meadows and pastures.
13. The hygiene of cattle; first aid in diseases or injuries.
14. Tocology.
15. The raising of calves and young cattle.
16. The utilization of milk, and the organization of sales.
17. Legislation and administrative procedure in connection with dairy control.
18. Bookkeeping in dairy control.
19. The duties and tasks of tne testers and inspectors.

The instruction given in the theoretical course serves as a basis for the practical course, which provides a thorough training in the actual work of dairy control. The students are required personally to perform all the work required in the stable, in the dairy, in the preparation of fodder, and in the keeping of the records. This work is to be done not only on the model farm of the course, but also on such other farms as may be visited by the students.

This course is designed to give the students practical training in the following:

1. The ear marking, measuring, and weighing of animals.
2. The weighing and measuring of milk.
3. The taking and preserving of samples of milk.
4. The testing of milk for butterfat contents.

5. The preparation of fodder of all kinds.
6. The weighing of feed rations; the giving and placing of fodder.
7. Milking and aftermilking.
8. The straining, airing, cooling, and storing of milk.
9. The supervision of grazing cattle.
10. The care and management of cattle; keeping the stable clean.
11. First aid in cases of injury or sickness.
12. Assistance in delivery.
13. Complete bookkeeping of dairy control; the making up of feed budgets.
14. The collation and analysis of the results recorded.

After the completion of the course an examination is held to test the student's learning, manual dexterity, ability, initiative, persistence, and working efficiency in general. Diplomas are issued to the students on the basis of the tests.

In addition to these educational courses, it is proposed later on to institute supplementary courses for the graduates in active service, to render them familiar with the latest discoveries made since their graduation in both science and practice.

The provisions made for the instruction, both theoretical and practical, of the testers and inspectors seem to be ample.

These courses are not confined to the candidates for official positions, but are open to practical farmers desiring to extend their special knowledge of dairying or cattle breeding. Thus the courses may, in a way, take the place of special schools for breeders. The sons and prospective heirs of farmers are likewise encouraged to attend these courses and, after graduation, serve for a time as testers or inspectors. In this way the courses will provide instruction not only for the prospective officials, but also for practical farmers and cattle breeders.

Under the regulations of the Ministry of Agriculture the work of dairy control will be carried on according to a uniform method throughout the territory of the Czechoslovak Republic. There are to be two grades of control:

1. Complete or strict control.
2. Partial or advisory control.

The work of dairy control may also be carried on by private parties, e. g., large landholders outside the testing organization, employing their own testers. The regulations in force do not apply to private control. This form of control may likewise be complete or partial. Private parties may obtain the assistance of public research institutes on payment of special fees. In matters of public control such aid is given free of charge.

Strict control is not confined to the current computation of the quantity of the milk obtained and its butterfat contents; it has to ascertain also the specific weight of milk and the total of solids, two elements of importance for a correct estimate of milk production.

In practice the tester himself computes only the butterfat content (and sometimes not even that) and sends samples for detailed examination to the State Institute for Dairy Research at Prague (for Bohemia) or to the dairy section of the Moravian Institute for Zootechnical Research at Brno (for Moravia and Silesia). The results of the examination are immediately reported to the tester, who notes them on the books of record.

Advisory control is identical with the present practice of computing the quantity of milk and its fat yield, and calculating the total yield of butter and the yield of milk with 1 per cent of fat.

Strict control has been introduced only in the principal breeding districts where cattle breeding and dairying show a relatively high development.

Advisory control is intended to improve conditions in districts where the development of the animal industries is mediocre or below the average, and to stimulate interest in cow testing, intensive milk-production, and scientific breeding, so that complete dairy control may soon be introduced and new breeding or dairy districts created. In regions where the animal industries are rather backward such regular advisory control may be reduced to mere occasional tests, to be expanded later into regular and detailed control as the breeding improves. It seems that such a beginning must be made for the present in a majority of the breeding districts in Czechoslovakia.

The tests are to made at intervals of 14 days. In the two weeks the inspector is to test successively all the herds in his jurisdiction. As he has 12 working days he can test 12 herds in all. The herds naturally must be neither too large nor too small.

In view of the expense connected with dairy control, 10 head of cattle is to be considered a minimum herd. On the basis of experience, the maximum has been placed at 50.

The inspector, accordingly, has to test 12 herds, of 120 to 600 dairy cows in all, on the supposition that the herds are located in such a way as to permit the tester to reach all the herds on time.

However, as it is intended gradually to introduce dairy control everywhere, it is probable that at first it may be necessary in many cases to test herds containing less than 10 dairy cows. In such cases it is expected that the inspector will be able to test two such small herds in one day when they are located in the same commune, so that he can be present at each milking.

Where it is not possible, for any cause, to introduce control at intervals of two weeks, the inspections will be made at intervals of three weeks. Such will be the case chiefly in those regions where advisory control is being introduced for the first time. Dairy control at three-week intervals will naturally be considered as one of lower grade and security, and the cows and herds thus inspected (at three-week intervals) will receive a lower classification.

Intervals in excess of three weeks will not be permitted—with the sole exception of cases where, owing to a backward condition of the cattle industry, an irregular advisory control is to be introduced as explained above. The reason is that, with control at intervals exceeding three weeks, the results are not correct enough to furnish a reliable basis for estimates of future yield, and even the smallest expenditure is too large where the results are not reliable.

Books and blanks for the recording of the results of dairy control (notebook for the testers, book of control, annual summary of the yield and production of the individual dairy cows under control) have been issued by the Ministry of Agriculture in a uniform edition and will be supplied to the communes as needed.

Feeding is one of the most important elements of dairy control. It is one of the objects of dairy control to place feeding on a scientific basis, so that the dairy cows shall be fed in proportion to their production and shall not receive more food than they are able to convert into milk, while their productive capacity is to be utilized to the utmost by sufficient rations. Through a strict control of the productivity of the individual dairy cows the highest financial returns are to be secured to the dairyman. A reliable system of feeding is necessary for that purpose, and if dairy control is to be carried out methodically throughout the Republic the system of feeding must likewise be uniform—this also for the purpose that the results of control in the Republic may be comparable. For these reasons the question of systematic feeding has received considerable attention in the reorganization of dairy control in the Republic of Czechoslovakia.

Kellner's principles are followed in estimating the feed value and computing balanced rations, the following being taken into account: Total dry matter, digestible albumen, and starch value, the latter being designated, however, as "Kellner's feed units." This is done for the reason that the expression "starch values" might give the agriculturist a wrong idea concerning the starch contents of the various foods, whereas Kellner's starch value indicates the productive capacity of all the digestible nutrients; and for the additional reason that the designation of "Kellner's feed units" has a better chance of becoming popularly known since the expression "feed unit" is already current.

Normal balanced rations are to be computed according to special tables. These tables, with detailed directions for their use from the pen of Prof. J. Just, have been published by the Ministry of Agriculture. The first of them shows the needed quantity of dry matter, digestible albumen, and number of Kellner's feed units for a varying milk yield and weight. The table shows the quantity of neutrients needed with a milk yield increasing by 2 kilos, which is sufficient for all practical purposes, and with the live weight increasing by 50 kilos, which too is sufficient, since the live weight of the dairy cows only serves as a basis for the computation of the sustenance part of the ration. It is well known that the size of the sustenance part of the feed ration does not depend so much on the live weight of the cow, as the smaller animals are usually more active, so that their need of nutrients is not so much less than with larger animals. The other tables give a list of the various feeds, showing for each of them the amount of dry matter, albumen, and number of Kellner's feed units contained; and this not only in percentages, but also for specified weights of the feed as they are used in practice: For 5, 10, 20, and 30 kilos of watery feeds, and for 0.5, 1, 2, and 3 kilos of dry fodder. This manner of tabulation means a saving of time, as the quantity of the nutrients named can be read from the table directly or can be found by simple addition, whereas the more difficult process of multiplication is required when the tables show percentages only, and errors may easily be made. The tables also show the lime contents of the feeds in percentages. In case a ration lacks a certain quantity of nutrients, a larger number of feeds is to be used; two additional feeds at least. Another table can be consulted in that case. In this way a balanced ration can be easily computed from the tables or from graphs so that the whole process will be very simple and at the same time also exact.

Dairy control includes also the keeping of herd books. Dairy control, no matter how well organized or administered, can not be a success without a scientific breeding of cattle, and the herd books are an indispensable basis for scientific breeding.

The herd books prescribed for the new dairy control differ considerably from the herd books of former times. They are to be a record not of the best animals only but of all animals kept for breeding (that is, of all dairy cows, for the records of bulls have always been kept). Similarly a record is to be kept not only of some selected descendants but of all descendants.

This new method of keeping herd books has been made necessary by the new discoveries in the theory of heredity, particularly those of Mendel, which have shown that in order to estimate the breeding value of an animal it is not enough to know its direct ancestors only, but that the collateral lines (brothers and sisters, cousins, uncles, and aunts of various degrees) must also be known, as the latter will exhibit many qualities, good or bad, which might be latent in our breeding animals and reappear in their descendants. If we are to form a reliable idea of the breeding value, that is, of the hereditary disposition of our animals, we must know such collateral lines also.

Another demand of the present doctrine of heredity is likewise to be met by the new herd books. To form a proper estimate of the qualities of an animal intended for breeding it is necessary also to know the external conditions of its development. According to the degree in which such external conditions were favorable or unfavorable to the development of the animal or its special qualities, we can judge of the " strength " of its qualities and determine to what extent the animal's qualities were determined by inheritance and to what extent they have been influenced by external factors and living conditions; and we may find an explanation why notwithstanding the same original disposition different qualities have developed in two individuals, or why in other cases the development of the animals is identical notwithstanding a different original disposition. That will show what qualities we may safely expect to be transmitted to offspring and to what degree.

This requirement is met by the introduction into the new herd books of special columns for noting the method of rearing (time and manner of weaning, mode of feeding, grazing, stable); the course of delivery; the development of the animal (increase in weight), etc., so that such pages of the herd books, properly filled, will give a thorough description of the animal's development, which is necessary for a reliable estimate of the adult animal as a breeder.

For the purpose of quick reference each animal will be designated by the name of its sire and a number showing when, in what numerical order, and in what commune it was born.

There will be three kinds of herd books.

1. Farm books.
2. Communal herd books.
3. District herd books.

The farm books are to form a basis for the keeping of breeders' records. They will be kept by each farmer and contain the record of his stock. They are of two classes:

1. Book of cows (dairy cows).
2. Book of calves and heifers.

The books are to contain all data of interest—weights, mode of feeding, method of rearing, condition of health. In this respect they are a foundation for the herd books proper. In addition, the inspector will note therein the results of dairy control by entering, in the book of cows, the annual yields. The book will also contain all data on origin and designation so that ancestors may be ascertained and the course of heredity followed.

The book of cows contains, on the first page, spaces for the record of the current number in the stable, designation (formerly, and at times even now, only in case of change); race and color; date of birth; whether reared on farm or transferred; origin (sire and dam with their designations and reference to herd book). These are the descriptive data. The two pages following are intended for the life history of the animal, with records of breeding, weight, milk production, etc. The last page is reserved for special notes.

The book of calves and heifers is to contain all data relating to the development of the animals up to the weaning of the calves or the first putting of a heifer to a bull. One sheet is reserved for each animal regardless of sex. The first page contains the heading showing the current number, sex, designation, and the corresponding number of the communal record of calves and the communal book of heifers, date of birth, origin, course of delivery, weight at birth and at weaning, and date of weaning. It will also show what disposition has been made of the animal, whether it has been killed or sold and to whom, or has been kept for breeding and where recorded. The second page is to contain entries as to the live weight and the manner of feeding and rearing the animal. The book closes for a bull with his first service as breeder, and for a heifer with the first calving.

The communal herd books are to be the chief records of breeding and control. They will be kept by the inspectors. They are of four kinds:

1. Book of bulls, including the present record of service.
2. Book of cows.
3. Book of heifers and weaned calves.
4. Communal record of calves born.

The latter two are about the same as the farm books, but their records and descriptions are more detailed.

The book of bulls, which is to be also a record of service, is made up of two-leaf folios with the headings on the first page and notes on the others. The heading contains data concerning the designation, origin, birth, and character of the animal, a statement of ownership and its changes, figures of meausurement, and a photograph of the animal. The notes are a record of each service by the bull, giving the designation of the cow, a statement of the results, a description of the calf, and data on the behavior, feeding, and weight of the bull.

The book of cows likewise consists of headings and notes. The heading is identical with that of the book of bulls, while the notes agree with the farm book, only the records are more detailed in following the development of the calf and the production of milk—being, in this respect, somewhat of an extract from the record book of dairy control.

The book of heifers and weaned calves has a heading with the designation and a brief statement of origin and final disposal of each animal (sold, killed, kept for breeding). The notes are a record of the growth, feeding, behavior, and health of the animal until the first service of a bull or the first calving of a heifer.

The communal record of calves contains entries of the births of calves born in the commune, regardless of ownership, and is kept by the year. Each calf is given a current number according to the order of its birth. Beside date and number the record also shows sex, sire, dam, date of covering, course of delivery, and live weight at birth, with a brief description of the condition of health and final disposal of the animal.

The district herd books are intended as summaries showing the progress of cattle breeding in a given district. They are:

1. A record of breeding animals.
2. District herd books: (*a*) For bulls; (*b*) for cows.

The record of breeding animals is a list of all animals kept for breeding in the district, with references to the communal herd books, making it possible to ascertain the origin of the animals. It is kept for bulls and cows jointly.

The district herd books for bulls and cows are in substance copies of the communal herd books. However, only animals of special excellence and such as found a new line will be entered in them. These books are to promote the improvement of stock, as only the best will be listed.

A record in these books will mean that a special value has been placed on the animal; they will be a collection of the best lines and will indicate the highest progress of breeding in the district. The decision whether an animal should be listed in the district herd books is to be made by a commission annually on examination or at a special request of the breeder.

The district herd book will, therefore, in a sense, be a golden book of breeders, and is intended to stimulate the breeders to new efforts.

The tester's equipment.—All testers or inspectors will be provided with a simple technical equipment so they may properly perform the necessary analyses. This equipment, to be provided by the Ministry of Agriculture, consists of the following:

1. A pair of balances.
2. A small lamp with a bottle of oil.
3. A 100-cubic centimeter cylinder, graduated.
4. Burettes, 100 cubic centimeters, the number depending on the number of cows to be controlled in one day.
5. One Gerber's centrifugal for butyrometers.
6. One water bath for butyrometers with a tripod.
7. An alcohol lamp.
8. A thermometer.
9. A stand for the butyrometers.
10. Two 10-cubic-centimeter safety pipettes (for sulphuric acid).
11. Two 1-cubic-centimeter safety pipettes (for amyl alcohol).
12. Two 11-cubic-centimeter pipettes (for milk).
13. Twenty-four butyrometers.
14. Twenty-four rubber stoppers.
15. Two one-quarter liter cans for pouring out the samples of milk.
16. A bottle of Gerber's sulphuric acid, with a ground-in stopper. The size depends on the number of cows controlled on days of continuous control, reckoning 25 cubic centimeters per cow. Two bottles to be taken.

17. Two bottles of amyl alcohol, with ground-in stoppers. The size depends on the number of cows controlled on days of continuous control, reckoning 2.5 cubic centimeters per cow.
18. A broad-necked bottle with a cork stopper, for soda solution in which the stoppers are to be placed after the fat contents have been ascertained.
19. A bottle with 100 grams of soda for the preparation of solution at the place of control.
20. A bottle with 100 grams of liquid ammonia, with a ground-in stopper.
21. A brush to clean the pipettes.
22. A brush to clean the butyrometers.
23. A towel.
24. A bag to carry these utensils in.

The reserve equipment, which it is not necessary to carry along, includes 24 butyrometers, 24 rubber stoppers, a bottle of oil for the centrifugal machine, 2 pipettes for sulphuric acid, amyl alcohol, and milk; 50 kilograms of concentrated sulphuric acid, chemically pure; 5 kilograms of amyl alcohol; a bottle of alcohol for fuel; soda; and ammonia.

The utensils mentioned under 1 and 2 are not needed in places where there is a permanent control balance. And when the analysis of milk is made in a laboratory, the utensils under 5 to 22 need not be carried, but the following will be taken:

One burette case, with lock.
One 1-cubic-centimeter pipette.
A bottle with 10 per cent solution of formaline.

The Ministry of Agriculture will also provide the necessary handbooks and books of reference for the testers, inspectors, and all officials charged with the work of organizing and building up the dairy control. The Czechoslovak Ministry of Agriculture has already issued a general handbook entitled "The Organization of Dairy Control in the Czechoslovak Republic," and other reference books on special questions of dairy control are in preparation. Thus far there have been published a book by Prof. J. Just on the methods of feeding, and a book by Dr. O. Laxa on certain aspects of dairying which the testers should know; instructions on the keeping of herd books are to be issued shortly. These books are to supplement the instruction given in the regular courses.

As will be seen from this brief sketch, a good foundation has been laid for the organization of dairy control in the Czechoslovak Republic. As I write these lines, the practical work of organizing dairy control is already in progress in the territories of Bohemia, Moravia, and Silesia under the direction of the respective boards of agriculture. The introduction of dairy control in Slovakia and Carpathian Russia has been postponed owing to the backward condition of the animal industries in those two former provinces of Hungary.

The work of organization and practical application of dairy control in Bohemia, Moravia, and Silesia is in charge of the boards of agriculture cooperating with the research institutes at Prague and Brno. Under the jurisdiction of the Ministry of Agriculture at Prague there are a number of research institutes for the animal industries, of which the following are of importance for dairy control:

Research Institute for Animal Biology.
Research Institute for Biotechnology.
Research Institute for the Dairy Industry.

At Brno there is a provincial zootechnical research institute with special sections for the various subjects.

These research institutes will be in charge of the scientific agencies of dairy control and will also collate and publish the results.

The organization, as described above, will be only temporary, however. The National Assembly is preparing a law by which the boards of agriculture are to be abolished and their places taken by chambers of agriculture consisting of the representatives of compulsory farmers' associations. The chambers of agriculture will then take charge of dairy control.

The work of dairy control will be financed by the Ministry of Agriculture, at least during the initial period. As soon as dairy control has been firmly established and has shown its practical value, the expenditures connected with the work are to be borne by the breeders and producers so that the contribution by the State will diminish from year to year, and the money so saved may be used for the work of introducing and organizing dairy control in new districts.

Chairman Pearson. You have heard two very interesting papers. I think we did well in postponing the discussion because it may be necessary to do some translating when we enter the discussion. There are three interpreters here—a French, a Spanish, and a German interpreter. Will you please announce that you are here to assist any who want your assistance in the discussion?

(The three interpreters did as requested.)

Chairman Pearson. If any of the authors I name are present, I would request that they kindly make known their presence: Dr. L. F. Rosengren, Mr. N. K. Jensen, Mr. K. H. M. van der Zande, Mr. G. Fascetti. Their papers will be read by title. I will now call upon the honorary chairman, Doctor Isaachsen, to present the next speaker.

Honorary Chairman Isaachsen. I now have the pleasure to present to you Mr. J. R. Dice, chairman, department of dairy husbandry, North Dakota Agricultural College, who will present a paper on "Vocational instruction in dairying in secondary schools." [Applause.]

VOCATIONAL INSTRUCTION IN DAIRYING IN SECONDARY SCHOOLS.

James Renfrew Dice, professor of dairy husbandry, North Dakota Agricultural College, Fargo, N. Dak.

The watchword of our American colleges has been service, so that instruction in dairy husbandry has naturally developed to meet the needs of the dairy industry, and the courses that attract students have naturally been the first courses offered.

In some States and institutions this development brought forth the college course, then the short course to supplement the college course, and finally the secondary school course. In other States the successful short course was the beginning of instruction in dairying, while in yet other institutions the farm school, or nondegree curriculum, offering vocational instruction in agriculture, including dairy husbandry, was the foundation of what are now large colleges of agriculture.

During later years separate secondary schools of agriculture have been established, either as State schools or county schools, and these schools are giving courses in dairying. Normal schools in several States are giving a course in agriculture, and in a select few of these schools the dairy course is adequate to train teachers for vocational schools.

In 1917 the Smith-Hughes law was passed, which provides for a Federal subsidy of one-half of the salary of instructors for the time they devote to teaching agriculture in approved secondary schools. This Federal subsidy and the supervision that goes with it have been responsible for "Smith-Hughes" high schools, established in all parts of the country. It is probably true that more students are obtaining vocational training in these schools than in all other secondary schools combined.

DEMAND FOR VOCATIONAL COURSE.

Vocational instruction in dairy husbandry is now offered in all parts of the United States. The demand for vocational courses is evidenced by the constantly increasing number of students who matriculate at the schools throughout the country. The enrollment of students at the school of an eastern agricultural college where both dairy production and manufactures is offered is perhaps representative. The school was organized in 1918, and the enrollment has been as follows:

	Enrollment.
1918	37
1919	209
1920	280
1921	324

OBJECT OF SCHOOLS.

The object of secondary schools is to give practical vocational instruction in agriculture to meet the needs of young men who are unable to take the regular four-year course but who wish to obtain a more extensive training than can be secured in the short course. The courses prepare for living in the country, whether that living contemplates actual farming or some more technical application of scientific agriculture, such as dairy manufactures. It has been found that students who want vocational training in dairy manufactures prefer a short course of from one to five months, while the longer course is preferred by those who wish training for dairy farming. For this reason the curiculum of most secondary schools is arranged primarily to prepare the student for farm life.

ENTRANCE REQUIREMENTS.

The entrance requirements for secondary schools vary somewhat. Most of them require that the student shall have completed the eighth grade in common school, or the equivalent, and that they be from 16 to 18 years of age. A few schools require that the applicant for admission shall have spent a specified time, varying from three months to a year, on a farm or in a dairy manufacturing plant. Practically all of the schools will allow the student who can not meet entrance requirements to matriculate on condition that they will demonstrate their ability to do the work. This privilege is usually granted only to those who can meet the age requirement, but in some cases younger students are admitted when they certify that they have completed all of the work available in their local school.

LENGTH OF COURSE.

The length of the vocational course in the majority of secondary schools is six terms of about 12 weeks each, although in some schools the terms are shorter or longer than that period. Some institutions give a two-year course, with three terms a year, running from October until June, but in a majority of the schools the course consists of two terms a year for three years, beginning in October and continuing until the end of March. The latter arrangement is preferred as it allows the student to be on the farm during the growing season when he is needed, and also when he can obtain practical training to the best advantage. In the high schools the course usually continues throughout the four years.

SUPERVISED PRACTICAL WORK.

In some States, where most of the students come from farms, no attempt is made to supervise their work during the vacations, but where a considerable number of the men are not farm reared, or come from farms where dairy cows are not kept, they are required to spend the vacation period in farm placement training. This training is under a supervisor, who is one of the regular instructors of the school. A representative plan of placing men is as follows:

> First, the students are interviewed as to the type of farm on which they are to be placed. Second, the student's qualifications are carefully itemized in a letter of application to the employer for employment. Third, each student is required to abide by all rulings made.
>
> Each student is expected to receive a reasonable wage, and earn it. Students are visited in training by the supervisor of farm placement training, who may be called upon at any time for advice and will do all that is possible to cooperate with the individual needs of each student.

Placement training is insisted upon to a greater extent in the older States in the East than in the West, but the authorities in all parts of the country recognize that if the student does not receive actual experience wih a dairy herd on the farm, it is hopeless to give him the training at the school that will qualify him for actual dairy farming. In other words, the boy must learn from actual experience that dairy cows should be fed and attended to regularly; and he must feed and care for them under varied circumstances with his own hands before he can be trusted to do the work without supervision. A school can require the boys to do this work in the school barns for short periods as a kind of laboratory work, but it is impossible to give a large number of students the necessary practice in one barn, and even if it were, practically all institutional barns are not so well adapted for this work as a dairy barn where the owner is depending on the herd for a living. In the agricultural high schools supervised projects are required of all students taking vocational work.

LOCATION AND EQUIPMENT OF SCHOOLS.

There is a secondary school in connection with many of the colleges of agriculture in the United States. and, as previously stated, a few of the States maintain agricultural schools. A number of county agricultural schools have been established throughout the country, and several normal schools offer special courses to train teachers for the vocation of teaching agricultural subjects in the various kinds of schools. The "Smith-Hughes" high schools are widely scattered throughout the United States.

THE COLLEGE SCHOOL VERSUS THE LOCAL SCHOOL.

The school located at the State college of agriculture enjoys several advantages, while the State or county school, built as a separate unit, has a number of things in its favor. The student who attends the school at the college works in a well-equipped laboratory in every department, and has available for his stock judging and practical work the college dairy herd and the farm, which are usually more complete than a local school could afford. This student enjoys most of the opportunities and advantages offered by a college community, he has for his instructors the trained college staff, and has for his classmates men of his own age or older who are well confronted with the same problems; this group mingles with the other college groups, and for the time being experiences the feeling of being a college man.

It is true, however, that the men in the secondary school of the college are often looked down upon by some of the collegiate students; and while the school usually has its own social, forensic, and athletic organizations, these activities do not receive the local recognition accorded to similar organizations in local, State, or county schools.

The students of the regional State school, in addition to obtaining vocational training, must of a necessity make the student activities what they are, and in this way a training in leadership is obtained that is valuable. These students are the institution, they make up the athletic teams, the dramatic clubs, and like organizations, and write and edit the student publications. A senior student in a State school is a peer. If he has the qualifications necessary for a leader, these qualities will have full opportunity for development and recognition. The older men who come to these schools will find a number of congenial companions of their own age.

The physical equipment of the State schools are quite complete as far as instruction in dairy production is concerned; but few, if any of them, are equipped to give instruction in dairy manufacture other than for the making of dairy products on the farm. What the herds and barns lack in size they make up for in adaptability and availability for vocational training work. The staff of the State school compare favorably with the instructors at the college. While they do not, as a rule, have the training and experience that the college staff has, and have to teach a number of subjects, they have the advantage of an intimate, personal contact with the student and are able to help the individual student with his problems.

The character of the work and type of students at these State schools are such that if any of the men decide to go to college the work that they have completed will be of considerable help to them during their college course.

The county agricultural schools are serving a useful purpose in many parts of the country, but they are not on a par with either the college schools or State schools. The county school falls short of having a complete physical plant; it is distinctly a local institution, so that it does not appeal to any large group of students and the students at these schools are quite young, so that the older men turn to the college for their vocational training. The county schools are quite deficient in equipment for vocational training in dairy husbandry because they do not have the necessary dairy herds nor dairy laboratories.

A number of normal schools give excellent courses for those who are preparing to teach agriculture, but few of the normals attempt to give full courses in dairying. However, there are exceptions, and these normals give dairy courses that are as good as those offered anywhere to prepare men and women for teaching farm dairying or for carrying on dairy farming.

The high school offering training in vocational agriculture is, of course, a local institution. Such schools do not give as thorough training as the schools of agriculture, but have the advantage of interesting students in high school that are indifferent to other sciences and to the classics. It gives them valuable help if they return to the farm and prepares them for college entrance if they become interested and decide to go to college. The equipment of the "Smith-Hughes" high school is apt to be quite deficient, as the Federal subsidy does not aid in the purchase or maintenance of equipment.

THE COURSE OF STUDY.

The course of study varies considerably in the different schools. All courses include work in the supporting sciences and in English in addition to the technical agricultural and dairy subjects. It is a common practice to require all the students to take the same course, as far as their work in agriculture is concerned, during the first year. Other schools allow the students to major in a certain course at the time of enrollment.

The following course of study is given as a representative outline of work:

FRESHMAN YEAR.

[Required of all courses.]

First term (23 hours):		Second term (23 hours):	
English	4–0	English	4–0
Farm arithmetic	0–4	Carpentry	0–2
Biology	2–1	Biology	2–1
Science (chemistry)	3–2	Science (chemistry)	3–1
Cattle (breeds and judging)	2–0	Horses, sheep, and swine	2–0
Poultry	2–1	Elementary dairying	1–2
Physical training	2–0	Stock judging	0–2

Six months placement training required.

JUNIOR YEAR.

Required first term (23 hours):

Parliamentary practice	1–0
Horticulture	1–1
Feeds and feeding	5–1
Carpentry	0–2
Soils	2–2
Physical training	2–1
Electives—	
Debating	3–0
Advanced testing	1–1
Soil fertility	3–0
The horse	3–0
Farm poultry	2–2

Required second term (23 hours):

Accounts	0–3
Civics	3–0
Horticulture	1–1
Farm crops	3–1
Physical training	2–1
Electives—	
Butter making	1–2
Principles of breeding	3–1
Sheep and hogs	2–1
Forge	0–2
Farm poultry	2–2

Six months placement training required.

SENIOR YEAR.

Required first term (23 hours):

Farm management	4–0
History	5–0
Electives—	
Cheese and ice cream	1–2
Dairy cattle management	4–1
Diseases of animals	5–0
Farm engineering and repairs	5–0
Advanced soils	3–1
Woodland forestry	2–1
Poultry marketing	1–2
Fruit growing	2–1
Small fruits	2–0
Floriculture	0–2
Landscape art	2–0
Home orchards	1–0

Required second term, all elective (23 hours):

Farm management	3–1
Animal breeding	3–0
Market milk (bacteriology)	2–2
Sanitation and water supply	2–0
Farm machinery	3–0
Poultry farm management	1–2
Bee keeping	2–1
Farm crop diseases	2–2
Advanced farm crops	2–1
Fruit growing	2–1
Vegetable gardening	4–1
Floriculture	0–2

As previously stated, the vocational courses given by the high schools consist of from 25 to 50 per cent agricultural subjects. In States or communities where the students are interested in dairy farming, fully half of the work in agriculture is on dairying or related subjects; in fact, all of the work is such that it should be included in a vocational course in dairy husbandry. It is exceptional to find the necessary equipment in these schools for instruction in dairy manufactures.

REQUIREMENT FOR GRADUATION.

The usual requirement for graduation from the schools of agriculture is the completion of about 126 credits, in approved subjects, including the work required of all students. The diploma is withheld by some institutions until the graduate has completed a year of practical work.

COLLEGE CREDIT.

Many of the graduates of the agricultural schools decide to continue their studies and enter college. The man who is not a high-school graduate asks what the basis of entrance to the college course will be in his case, and the colleges aim to encourage the students of the secondary schools to take college work and usually, either directly or indirectly, give some recognition of the work that they have completed in the school at the college, but graduates of State or county schools receive little if any credit.

As to entrance requirements for students that have completed the course in a school of agriculture but are not high-school graduates, one college of agriculture states definitely, "The nondegree courses are not preparatory to work in the University of ———, nor do they yield credit toward the degree." The rule of another is, "Graduates of the school of agriculture of the University of ——— who have completed the two summers of supervised farm work offered in the school course, one additional school year, and one additional summer's work, or the equivalent thereof, will be admitted to the college of agriculture." Other colleges are somewhat more liberal, but in no case is the school of agriculture recognized as a preparatory school for college.

College credit is not given for work done in the school of agriculture except in exceptional cases. Sometimes a student is excused from taking a required college subject, without credit, to avoid repetition.

Vocational instruction in agriculture in secondary schools has made tremendous progress during recent years, and vocational training in dairy husbandry has received its full measure of attention, but as the dairy industry continues to grow and increase in importance there is every reason to believe that as our secondary schools are developed one of the marked improvements will be enlarged and improved herds and barns, together with adequate laboratories for the vocational instruction in dairy husbandry.

Chairman PEARSON. Everyone who is informed about the development of dairying throughout the world knows of the wonderful things that are being done in Canada. He knows about the great center of dairy education and has no doubt been told that much of the inspiration which is responsible for the splendid work of our dairy friends in Canada is due to the veteran leader—I hope he will excuse me for putting in the word "veteran," for I don't want to carry the idea that he has gotten along to the time when he should retire on a pension—Prof. H. H. Dean. As compared with some of the rest of us he is a veteran leader because he has been in the work longer than most of us.

You are to hear now from Prof. H. H. Dean, professor of dairy husbandry of Ontario Agricultural College, who will read a paper on "Methods of teaching dairying to college students." [Applause.]

METHODS OF TEACHING DAIRYING TO COLLEGE STUDENTS.

HENRY H. DEAN, B. S. A., professor of dairy husbandry, Ontario Agricultural College, Guelph, Canada.

Successful living is largely a matter of adjusting ourselves to our surroundings. The successful teacher must be an adept in order to adjust himself or herself to a new class of students each year. If it were not for the fact that mankind in the mass acts much the same under a given set of conditions, it would be difficult, if not impossible, for a teacher or lecturer to obtain satisfactory results in his or her classes, because of the great variety of human subjects which appear in the classes to be taught.

The writer of this paper speaks from 32 years' experience as a lecturer on dairy problems at one institution. It is of this experience he wishes to speak.

In the first place, the lecturer must be able to command the confidence and good will of his or her students. No one can hope to succeed with classes who fails in this respect. In order to secure the will to learn among students, the teacher must know his subject thoroughly, must have confidence in his ability to teach (but not overconfidence to such an extent that conceit is the dominating feature), be enthusiastic, and able to provoke enthusiasm in those who are taught, and have the faculty of seeing problems from the students' viewpoint. Sympathy with. and encouragement of, classes are also important factors in securing good results as a teacher or lecturer.

Some teachers rely almost entirely on the lecture plan. He needs to be an exceptionally good lecturer who can impart the necessary information on a subject like dairying without the aid of laboratory practice. In connection with the lecture plan, the writer has tried dictation of notes, in the class, which is a time-wasting method; and allowing students to take their own notes, which is not satisfactory except with those who are expert note takers; also the plan of placing notes on the blackboard to be copied during the lecture period has been tested, but this distracts the attention of the class too much. The best plan is to use a textbook, together with what explanations may seem necessary. The students then have the main facts of the subject before them. If they miss a lecture or two due to sickness or other causes, they can get most of the material from the textbook; and if the lecturer, through absence or lack of sufficient time, is unable to cover all the work assigned to the class, the students may be held responsible because of the fact that the textbook contains the kernel of the subject. There is just one danger in the use of a textbook, namely, that students may think it is unnecessary for them to attend lectures. This is a mistaken idea, as the presence of a good lecturer is a source of inspiration to the student. Pleasing personality is also an important factor in a good teacher or lecturer. This is something not easily defined, but is a valuable asset.

Regarding textbooks, I would observe that these should be concisely written, clearly expressed, and free from " vain repetitions." Many textbooks are altogether too voluminous for classroom work. A good index is helpful. A few good illustrations aid the student in grasping the idea.

But lectures alone, no matter how brilliant the lecturer, nor how good the textbook, are not sufficient for the teaching of a subject like dairying. Laboratory work is needed for best results. The amount of laboratory work which can be given depends on the nature and amount of equipment at hand, the time allotted to the subject, and the staff available. A much larger staff is needed in the laboratory than in the lecture room. The number of students who may satisfactorily receive lectures is limited only by seating capacity and the range of the human voice for good hearing. In the laboratory, a maximum of 20 to 25 students per teacher is all that should be allowed; 10 to 15 is better.

The ideal plan is to provide individual laboratory work for each student to such an extent that he or she may become a proficient practical operator in each branch of dairying. For example, in milk testing there should be sufficient equipment in the laboratory to allow each member of the class to work out each and every problem by himself or herself. The same with cheese making, butter making, ice cream, and condensed and powdered milk manufacture. I realize that this means a very heavy expenditure for building and equipment as well as for instructors, but it is needed for the best results in teaching the science and practice of dairying.

In addition to the lectures and laboratory work given at a school, college, or university, it is advisable that students visit as many as possible of the commercial dairy plants and marketing centers. Better still, require that students spend at least two or three seasons in the various branches of commercial dairying between college terms. Students trained in this way are able to do credit to themselves and to their alma mater, when they go out into the practical everyday business of the world, where men are usually rated by what they can *do*, rather than by what they are supposed to *know*. One thing which characterizes modern science more than anything else is that it aims to solve practical, rather than theoretical, problems. The great French scientist, Pasteur, is reported to have said: "Nothing is more agreeable to a man who has made science his career than to increase the number of discoveries, but his cup of joy is full when the result of his observations is put to immediate practical test." On another occasion he said: "Work can be made into a pleasure and (it) alone is profitable to a man, to his country, to the world." This latter observation should put to shame any student who is inclined to look upon a college education as a means of enabling him to live a life of ease, and to get a living as well as have a good time, without working.

As to the relative merits of short and long courses in dairying, my experience leads me to think that both are necessary for the best results. While there is no doubt a tendency, in a new country like Canada, for students to think they can get all that is needed in the way of dairy education in 2 to 10 weeks, the best dairymen at our college are those who have taken a short course of 10 weeks, and then have entered for the regular four-year course, specializing in dairying during the third and fourth years. The first two years consist of broad courses in general agriculture and the sciences relating to agriculture, together with training in speaking and writing the English language. This prepares a student for his special subject, dairying, and gives him a broader viewpoint on life's problems, so that he may the better adjust himself to the conditions likely to be met with in his pathway through life.

The demand for men trained in this way exceeds the supply The graduates in dairying from the Ontario Agricultural College have good positions awaiting them as soon as they leave college. The salaries which they can command in commercial work are usually greater than are paid for teaching. In fact, there is danger of our colleges losing many of their best teachers because the salaries are too low. In addition, those who remain will be difficult to replace on superannuating, because the young men are chiefly going into commercial branches of dairying. Few are attracted to academic work. This is a serious situation in both Canada and the United States. The remedy is to make the teaching of dairying and the investigating of dairy problems quite as attractive as commercial propositions, not only from the viewpoint of remuneration, but also by giving the very best support possible in the way of satisfactory buildings, equipment, and teaching staff, in order that the work may be carried on satisfactorily by those who are responsible for the training of future dairymen.

Chairman **Pearson**. Professor Dean has proven to you that I was right when I said something about a source of enthusiasm in the office which he occupies. I hope that for many years to come Professor Dean will continue his position of leadership in the dairy industry of Canada.

And now we are to hear from two of the great dairy teachers of the United States. The first made his reputation a good many years ago as a dairy bacteriologist, in the days when bacteriology was just beginning to be applied to dairy work. He went to Cornell University from Connecticut. He has served as head of the great dairy industry department in that institution for some 11 or 15 years, I believe, and it is not too much to say that very largely through the splendid work he has been doing there, Cornell University has been rewarded by receiving an appropriation for a dairy building costing in the vicinty of $400,000, which is to be dedicated in the next few days.

I understand that in answer to his earnest desire, he is to be given an opportunity to specialize upon certain dairy investigations, research work which he has been anxious to take up these many years, but has been prevented by his administrative duties as head of the dairy department and for a time as acting dean of the New York State College of Agriculture.

I have great pleasure in presenting to you Professor Stocking who will speak on "Collegiate instruction in dairying." [Applause.]

Prof. W. A. **Stocking**. Mr. Chairman and members of the World's Dairy Congress: The chairman calls to my mind the story that was told of Henry Ward Beecher. It seems that at a meeting where Mr. Beecher was to speak, the chairman put himself out to eulogize Mr. Beecher in a most flowery and eloquent way. When Mr. Beecher got the floor, he said, "Mr. Chairman, your introduction makes me feel now just the way the pancake feels when the molasses is poured on." [Laughter.]

The chairman in his introduction failed to say that the service which he rendered at Cornell University was responsible for the building of the dairy building which the department there has occupied during the 17 years that I have been at Cornell. That was back in the days when it was a new thing for a college of agriculture to secure from the State a large appropriation for the development of a building for dairy industry, and that building has stood as one of the landmarks in the development of dairy education in this country.

The chairman also mentioned the fact that I was to be given an opportunity for endeavoring, at least, to do a little research work instead of devoting all of my time to the administrative duties which have taken my time for the last few years. I would like to remind him that I am now simply endeavoring to carry out the agreement that was made at the time he brought me to Cornell some 17 years ago when he definitely agreed that I was to have half of my time for research work. [Laughter.]

COLLEGIATE INSTRUCTION IN DAIRYING.

William A. Stocking, professor of dairy industry, Cornell University, Ithaca, N. Y.

Because of the vital relationship which exists between dairying and successful general agriculture, dairy work has developed as an important part of the farming activities of nearly all our States. For this reason the colleges of agriculture have developed teaching and research facilities in this field to meet the needs of the industry. In the growth of the educational work in dairying, in the colleges of agriculture two types of organization have developed. In the one type, all of the work relating to dairying has been included in one department usually known as that of "dairy husbandry." Pennsylvania, Michigan, and Illinois are examples of this type of organization. In these institutions the courses of instruction relating to the breeding, feeding, and management of dairy cattle, together with courses on the composition and testing of dairy products, the handling of milk, and the manufacture of the various types of dairy products, are all included in the one department.

In the other type of organization, the work relating to dairy cattle is combined with similar work for other groups of farm animals in a department usually known as "animal husbandry," while the work with the handling and manufacture of milk and its various products is cared for in another department, in which case the term, "dairy industry," is usually applied to the department. New York, Ohio, and Wisconsin are examples of this type of organization where the dairy work is divided between two departments.

The first type of organization may lead to a certain amount of duplication of work, since such courses as the principles of breeding and feeding are usually given by the department of animal husbandry for other groups than dairy students, while the department of dairy industry gives similar courses for its own students.

The second type of organization is based on the theory that the principles underlying such subjects as the breeding and feeding of cattle whether they be for dairy or other purposes are substantially the same and can be given to all students in the same course, regardless of the group of cattle in which the student may be especially interested. The same thing is true of certain other courses. At these institutions it is felt that the logical point of division is between the animal and its products rather than between the types of animals, and that the work can be more economically given where one department handles the courses having to do with the animal, while the other department covers the handling and manufacture of the milk and its products.

Nearly all of the colleges maintain in one or the other of the departments described herds representing the leading breeds of dairy cattle, to be used for instruction work with the students, and for experimental purposes. These herds usually include representative animals of the Jersey, Guernsey, Ayrshire, and Holstein breeds, and in some of the States milking Shorthorns as well. Frequently the large part of the herd consists of the particular type of dairy animal which may be best suited to the commercial needs of the State. Thus we find in States where fluid milk is the most important dairy product, Holsteins compose the larger part of the college herd, while in States where butter is more important a larger percentage of the college herd consists of Jerseys or Guernseys.

In some States the dairy department also maintains a farm for the production of feeding stuffs for the dairy herd and the study of problems in connection with this phase of the work.

In order to have material for laboratory work, many departments maintain a fairly good-sized commercial dairy business—in some of the larger ones amounting to a cash turnover of from $100,000 to $200,000 or more per year. If properly conducted this commercial work is of great value to both students and teachers, since it makes it possible to give laboratory work of a really practical nature and gives opportunity for the study of many problems which would otherwise be impossible.

In many of the institutions, the teaching work having to do directly with the breeding, feeding, and management of dairy cattle developed first. This is natural because these are the problems confronting the dairymen in regions where milk production is new, and the colleges have tried to meet the most important needs of the farmers. Later, corresponding courses in the handling of market milk, the manufacture of butter and cheese and other dairy products have received due attention. The more recent development in the teaching work includes courses in the condensing and powdering of milk, in the making of certain types of fancy cheeses, the manufacture of by-products, and in dairy economics and dairy management as applied both to dairy farms and dairy plants, and courses in the marketing of dairy products.

The particular lines of work given special emphasis depends very largely upon the relative importance of the different dairy products in each State. For example, in States like Wisconsin, special emphasis is given to instruction work in connection with the Cheddar cheese industry. In Iowa, similar emphasis is given to the manufacture of butter, while in New York State special attention is given to the handling and marketing of fluid milk, because of nearness to markets and the relative importance of this product as compared with butter and cheese and the other manufactured dairy products.

In institutions where it is the policy to lay out prescribed lines of work for the students who are fitting themselves for special fields of work, students of dairy industry follow a fairly definite course in which the work is all prescribed. The University of Illinois is an illustration of this method of instruction.

In certain other institutions where the policy is to allow students a free selection, the work in dairy industry is optional, leaving the student free to elect little or much as he may desire. This condition exists at Cornell.

The production and management of dairy cattle and the handling of dairy products requires a thorough knowledge of the underlying principles of such sciences as genetics, chemistry, and bacteriology, and it is interesting to note that thorough courses in these subjects are required of students specializing in dairy work in most of our departments.

It is of interest to note that as a result of careful consideration by a committee composed of the heads of nine dairy departments and representatives of some of the leading commercial dairy interests, it was the consensus of opinion that students preparing for work in the field of dairying should receive as thorough a training as possible in the fundamental sciences, especially chemistry and bacteriology.

The following extract from the report of this committee will be of interest:

> The course of study which will best fit men for responsible positions in milk plants should include a thorough training in the fundamental sciences coupled with as much applied work as the student's time will permit.
>
> The fundamental sciences should include chemistry, physics, and bacteriology, each to be followed by courses making clear their application to the market-milk industry.
>
> The applied courses should include work in market milk, butter, cheese (including fancy cheeses), ice cream, condensed milk, powdered milk, dairy by-products, and dairy machinery.
>
> The instruction in these courses should be directed toward showing the application of science to these subjects as well as to develop manual skill.
>
> Special attention should be given to the subject of economics. The work in this field likewise should include training in both fundamentals and their application to dairy problems.
>
> During the senior year there should be a course in milk-plant management which should bring together and coordinate the previous teaching in scientific and applied courses.
>
> We feel that the milk companies can render valuable assistance in the better development of good men by making it possible for students to get experience in milk plants during the summer months.

The number of courses and amount of dairy work given, varies in the different institutions, depending upon the importance of the dairy industry in the particular State. In some of the larger dairying States from 10 to 15 courses are offered in strictly dairy work, some institutions giving a total of more than 40 university credit hours.

The dairy instruction in our colleges of agriculture is planned to give students a working knowledge of the basic principles involved in the production and handling of dairy cattle, market milk, and the manufacturing and marketing of dairy products, and it is believed that students who have faithfully pursued the courses of instruction prescribed by our dairy departments should be qualified to fill, with at least a fair degree of success, positions as practical dairy farmers, breeders of dairy cattle, superintendents or managers of dairy farms, and operators of dairy plants. It is also believed that this collegiate instruction lays a foundation for additional work as graduate students which will prepare persons for positions as scientific experts in connection with our large commercial dairy concerns, for teachers in the universities and secondary schools and for research workers in Government departments and State experiment stations.

Chairman PEARSON. Mr. Stocking came back with a pretty good punch, so I don't know what to say about this next speaker. I think I will follow the advice of Mark Twain when he said, "When in doubt, my son, tell the truth." [Laughter.] That is what I tried to do for Stocking. That is what I am going to do for Eckles, let the consequences be what they may.

Professor Eckles also has been a leader in dairy education a considerable number of years. He has been a source of inspiration to a very large number of young men, and now they are older men who are scattered all over these United States. A good many of the leaders in different States point to Professor Eckles as their old professor, and they go to him yet, and always freely and with joy, to talk over their problems and get his best advice.

He has made a reputation for himself along various lines, but particularly in connection with dairy cattle, their feeding, breeding, and nutrition. For many years he served as head of the dairy work in Missouri, and then the great State of Minnesota reached right over Iowa down into Missouri and picked him up with their long, rich arm and placed him in charge of the work in dairying in the University of Minnesota.

I am very happy to present to you, Professor Eckles, who will speak to you on "Graduate instruction in dairy husbandry." [Applause.]

GRADUATE INSTRUCTION IN DAIRY HUSBANDRY.

CLARENCE HENRY ECKLES, D. Sc., chief, division of dairy husbandry, University of Minnesota, University Farm, St. Paul, Minn.

Mr. Chairman and gentlemen: Graduate instruction and graduate students are terms the usage of which is limited practically to American educational circles, and for this reason it may be well first of all to make clear the relation of graduate instruction to other lines of education according to the American system.

Graduate instruction, according to American usage of this term, means instruction after the completion of a four-year university course. The child after completing eight grades in the elementary or grammar school, normally one grade each year, enters the high school. The high school course normally covers four years, and prepares the student for admission to the university or college.

The curriculum of the university is arranged with the expectation that four years of nine months each will ordinarily be required for its completion, except in the case of professional courses such as medicine or engineering, where more time is often required.

One year of advanced study accompanied by the preparation of a suitable thesis leads to the degree of master of science or master of arts. The degree of doctor of philosophy or doctor of science represents a minimum of three years spent in graduate study, with the publication of a thesis which makes a contribution to knowledge. A graduate student is expected to devote about two-thirds of his time to his major subject, including the preparation of a thesis based upon his researches. In addition he selects one or more minor subjects closely related to and supporting his major subject.

The man who is interested in graduate work in dairy husbandry normally has completed a four-year curriculum in agriculture and therefore holds a degree from a university or college. Possibly he has served in a minor capacity on the staff of a college or experiment station or has been engaged in commercial lines. As a result of his experiences he has come to recognize that his best development in the future depends upon perfecting his technical knowledge of the subject.

The typical agricultural student in general does not make up his mind as to the subject in which he wishes to specialize until he reaches at least the third year of his course, often not until later. During the last two years in the university he has opportunity to direct his efforts to some extent along the line he has chosen. During the four-year university course in agriculture the student becomes more or less familiar with the sciences upon which agriculture and dairy husbandry practices are based and has had some instruction in the application of these sciences in the field in which he is interested.

If the student decides upon a business career, his school experience ordinarily stops when the university curriculum is completed. If, however, he decides to take up dairy work of a professional type—that is, to enter the field of university teaching, agricultural experiment station work, or the Government service—he finds the need of more specialized highly technical training within the field in which he proposes to work. A similar need for more highly specialized instruction is felt by some who decide to become technical dairy experts. A man in either of these situations finds that a period of from one to three years of graduate work meets his requirements.

The present status of graduate work in dairy husbandry can best be understood by a brief statement of the development of dairy instruction in American agricultural colleges.

The first instruction given in the United States within the field now known as dairying or dairy husbandry was a part of general instruction in agriculture. The first definitely organized instruction in dairying began about 1890 in the form known as short courses. These short courses dealt primarily with dairy manufactures and had for their object the vocational training of men as operators of butter and cheese factories.

The early instructors in dairy husbandry were either men educated in the sciences, especially chemistry or bacteriology, who had through their interest in dairy problems acquired a knowledge of the technical phases of dairy work, or were men who had been especially successful in commercial work, having in many cases been self-educated so far as technical dairying was concerned.

Beginning in the early nineties, courses in dairying began to be incorporated in the curricula of the best developed agricultural colleges. These early courses mostly dealt with the composition of milk, testing milk for fat and total solids, cream separation, and butter making. In those days this instruction was largely given in connection with the operation of commercial creameries and cheese factories. Systematic instruction in dairy production was not developed until considerably later. The first instruction dealing with dairy cattle was in judging animals, and in most institutions was a part of the general instruction in animal husbandry. Later, specialized courses were introduced dealing with the selection, care, and management of dairy cattle.

The first graduate students in dairy husbandry were generally assistants in the commercial activities of the dairy department. Since graduate instruction at that time was not organized in dairy departments, the few who did enroll for graduate instruction did the logical thing and worked under the supervision of an advisor connected with a science department, usually chemistry or bacteriology.

The writer is unable to say who were the first men to take advanced degrees as preparation for work in the field of dairy husbandry. Very few, probably not over four or five, received such degrees in an American institution previous to 1900.

Agricultural colleges in the United States were with one or two exceptions established as a result of an act of Congress passed in 1864. Development was exceedingly slow at first. Since 1900, however, the growth in number and the advance in standards has been one of the outstanding features of American educational advancement.

With this advance in standards, both in instruction and in research lines, has come the demand for better-trained men. The first men to be placed in charge of dairy husbandry departments were in some cases men without college degrees; in others, men trained in science who later took up dairy work.

In the next stage of development men who had undergraduate degrees in agriculture were given responsibilities in connection with dairy husbandry work in colleges and experiment stations, as more fully trained men were not available. Gradually men with master's degrees became more numerous and occasionally one even went so far as to complete the requirements for the doctor's degree.

The tendency at present is more and more to emphasize graduate study and an advanced degree as a prerequisite to election to an important teaching or research position. Already a few institutions have announced the general policy that a doctor's degree will in the future be a requirement for election as head of a dairy husbandry department.

THE PRESENT STATUS OF GRADUATE WORK IN DAIRY HUSBANDRY.

A recent survey of American universities and agricultural colleges indicates a total of 121 men enrolled in graduate work in dairy husbandry this year in 20 institutions. Of these, 57 are interested primarily in dairy products and 64 in dairy production. Of these, 23, or about 20 per cent, are candidates for the doctor's degree. This enrollment is probably more than double that of five years ago. The survey also shows the interesting fact that a considerable number of these pursuing advanced courses are preparing themselves for technical positions outside of college, experiment, or Government positions.

Inquiry concerning the minor subject shows chemistry and bacteriology far in the lead· followed by economics, animal nutrition, genetics, farm management, and veterinary science. Those who are interested in dairy manufactures with the object of becoming technical dairy experts in nearly all cases wisely select either chemistry or bacteriology as their minor, or both.

There is already a considerable demand for men who are well grounded in the technique of dairy manufactures and who are at the same time capable of becoming executives in marketing organizations. A considerable group of men are at present preparing themselves for such opportunities by making a study of economics and marketing. In some cases these men take their major in dairy husbandry and their minor in economics, and again the reverse order is followed.

Among students taking advanced instruction in dairy production there is clearly a tendency for a division of interests between those whose inclinations are toward college instruction positions and those who are expecting to take up work of an extension character or engage in commercial activities. The man whose interest is along lines that lead to teaching or research work usually selects animal nutrition, physiological chemistry, or genetics as a minor, while the man of extension bent is likely to select farm management or veterinary science.

THE LANGUAGE REQUIREMENT.

A reading knowledge of two languages, usually French and German, is the standard requirement of a candidate for a doctor's degree. For the master's degree a reading knowledge of one language is generally required, with a provision in many institutions whereby this requirement may be waived in certain lines of study, usually including agricultural subjects. No doubt the language requirement deters many graduate students from becoming candidates for the doctor's degree. Unfortunately for those who plan to pursue advanced courses, little if any foreign-language requirement is found in the typical undergraduate curriculum. Moreover, no tendency is noticeable to increase the foreign-language requirement for the undergraduate. Experience seems to indicate that only the small percentage of university graduates in agriculture who engage in work of a professional character make use of a knowledge of foreign languages.

The typical agricultural student during the first two years of his university course expects to go into commercial lines upon graduation. As he comes in closer contact with some of the specialized fields of work his interest may develop until he decides that a professional career has greater attractions than commercial activities. By the time he comes to this decision it is too late to take up the study of language. As a result he enters upon graduate work badly handicapped in language. He is confronted with the necessity of acquiring a reading knowledge of at least one language, or of two if neither French nor German was included in his preparatory course. Under these circumstances it is not surprising that the graduate student hesitates to enter a freshman class and begin the elementary study of a language.

The only suggestion that can be made in this connection is that as soon as a student finds that his interests are turning toward a professional career in the agricultural field he should at once begin to make up his deficiencies in language requirements in order that he may be in a position to pursue graduate work with advantage if occasion makes it desirable.

MIGRATION OF STUDENTS.

In European universities the student is encouraged to divide his course between two or more institutions. There are clearly advantages from such a procedure, but there are also disadvantages in this country, due to the distance between institutions, difficulties resulting from transfer of credits, and among State institutions to the high nonresident tuition. The result of these conditions has been to limit the attendance of nine out of ten undergraduates to one institution. However, when the student reaches the point when graduate study is contemplated, the advantages are all in favor of taking his advanced instruction in an institution other than the one from which his undergraduate degree was received. Even if the second institution is no better equipped in men or apparatus, there is a distinct broadening effect from working in another institution where somewhat different conditions and ideals exist. So important is this experience that only under unusual conditions should a graduate in dairy husbandry plan to continue his graduate course in the same institution. This principle is recognized to the extent that scholarships are sometimes awarded under condition that they may be used only in an institution other than the one from which the holder is a graduate.

SELECTING THE INSTITUTION.

Fortunate is the student who is privileged to pursue graduate work under the master teacher of his subject. The student in considering where to take graduate work should understand that he should pick the man under whom he desires to work rather than the institution. This man should be the master teacher of the subject. If he happens to be located at an institution well equipped in a material way, so much the better, but let this be secondary.

It sometimes seems that agricultural colleges are especially prone to overlook the principle, universally recognized but not always followed, that the first place to spend money liberally is on men, and, second, on buildings and equipment. A faculty of men outstanding in their respective fields means far more to an institution than magnificent buildings and equipment. This is not said in depreciation of good material and equipment, but to bring home to the student who may enter upon a graduate course the overwhelming importance of the man equipment in contrast to the material equipment of the institution he selects. The inspiration from working with a master mind is never lost and often shapes the entire future career of the student.

THE SELECTION OF MINORS.

The graduate student ordinarily is expected to devote about two-thirds of the time spent in graduate study to research work in his major field and the preparation of the material secured in the form of a thesis. The remainder of the time is devoted to a selected subject closely related to his major. For a student interested in dairy manufactures the logical thing would seem to be to choose chemistry or bacteriology, or both, for his minor. The survey made indicates that this is exactly what is being done at present. If his undergraduate instruction has been especially good in one of these sciences, the logical thing is to emphasize the other. Fortunate indeed is the dairy-husbandry department that has associated with it strong men in dairy chemistry and in bacteriology.

In recent years the development of organized marketing agencies and of the United States Bureau of Markets has resulted in a demand for men who are familiar with the manufacture of dairy products and at the same time are trained in economics, especially in regard to the marketing of agricultural products. This field is one of the most promising of all for the future. A number of students have seen these opportunities and are now enrolled in graduate courses preparing themselves for such activities. Some of these enroll with their major in dairy husbandry and a minor in economics, while some reverse the order and take a major in economics.

The man interested in dairy production should take advantage of his opportunity in graduate work to make up any deficiencies of his undergraduate days. For the man who desires to qualify for college and experiment station work, one of the best minors is physiological chemistry. Possibly no one subject will do more to broaden his knowledge of animal problems. Next stands genetics, especially when guided by a man with some ability in the way of applying the subject to problems of livestock production.

The man who expects to enter the extension field should ordinarily take his major in general dairy production and may well consider the advisability of a minor in agricultural education when a strong department in this subject is at hand. Others prefer veterinary science, which gives a training of immediate utility.

FINANCING THE GRADUATE STUDENT.

At least half, and possibly two-thirds, of those registered for graduate instruction in dairy husbandry in the United States are enabled to finance themselves at least partially through fellowships or assistant positions. All the leading universities and colleges make some provision for fellowships. Some fellowships require service to be rendered the institution in the form of teaching, others make no such requirement. For the young man who expects to take up graduate work immediately upon the completion of his undergraduate an opportunity to serve as part-time assistant in a first-class institution is especially to be recommended. The competition for such positions, however, is keen as a rule. The young man who receives an opportunity of this kind in a first-class institution should consider himself fortunate.

TAKING A MAJOR IN A SCIENCE DEPARTMENT.

To a man who plans to take graduate work the question often comes as to the advisability of taking the major in some related line more or less fundamental to dairy husbandry, such as genetics, chemistry, or bacteriology, rather than in dairy husbandry. It would appear that the answer depends upon conditions that may be set forth readily. A man who has had a rather extended experience in dairy husbandry work, especially following graduation, such as teaching or service on an experiment-station staff, will ordinarily profit more by taking his major in a science department provided the right man is available as adviser.

On the other hand, where the young man undertakes graduate work without an extended experience in applying the principles of science to dairy husbandry problems, and assuming a strong man in dairy husbandry is at hand, the logical thing is to place his major in this department. After all, the overshadowing importance of working under an outstanding man in his line should not be lost sight of when this decision is to be made.

CHARACTERISTICS OF GRADUATE WORK.

Students considering the advisability of enrolling for graduate work should understand that the purpose and nature of the instruction is quite different from that given the undergraduate in American universities. Some students seem to assume that it is merely a continuation of their undergraduate studies and that the professor has withheld some most important information or material for these advanced courses. During undergraduate days they have become accustomed to having their efforts largely directed by the instructor. When they enter upon graduate work and are placed almost entirely upon their own resources and their work supervised rather than directed, it often requires some time to orient themselves fully to the change. The typical graduate student, by the time he has completed his advanced course, begins to feel a power of independent thought and action never experienced before. He is able to realize for the first time the nature of the enthusiasm and satisfaction experienced by the explorer in the unbeaten paths of nature.

GRADUATE INSTRUCTION FROM THE INSTITUTION VIEWPOINT.

There are two parties concerned in graduate instruction—the student, and the institution as represented by the instructor. Graduate instruction is in recent years bringing to some institutions special problems that promise to become more important in the future. Some universities, or at least certain departments, are beginning to suffer from too much popularity along these lines. Most of the men capable of giving graduate students the help and inspiration which means so much to the development of the student gladly give a liberal portion of their time and energy to a group of graduate students. Instruction of this type, however, makes severe demands upon the adviser in the way of time and often upon the institution in the way of finances. The financial burden is especially heavy in those fields such as dairy husbandry, where to supply facilities for conducting research problems provisions are required for the use of a number of animals, the maintenance cost of which is very heavy, or for the use of considerable quantities of milk or other dairy products. Regarding the time required, the instructor is inclined to feel that this heavy expenditure is justified only for sudents of outstanding ability.

The slackening in demand for men which has resulted from recent financial conditions has been one factor in turning the thoughts of a much larger number of men towards graduate work. Among these have been some of mediocre ability that can not profit fully from such opportunities. Advisers of undergraduate students should be careful not to overstimulate interest in graduate instruction among those who are not especially gifted. It is not improbable that in the future some definite means of limiting enrollment to those especially qualified will be necessary.

GRADUATE INSTRUCTION AS A PREPARATION FOR COMMERCIAL WORK.

Modern scientific methods are being introduced into the dairy industry with such rapidity that the demand for trained technical men has been in recent years constantly greater than the supply. A few years ago an agricultural college student who specialized in dairy products probably had in view the operation of a creamery or ice-cream plant. Now the demand is far broader, and the opportunities are becoming more attractive from year to year. Within a few years most of the large city milk plants will be provided with a technical expert; the condensed-milk and milk-powder factories will have their experts, and the development of larger business units will make possible a greater financial remuneration for the technical expert of ability. The enormous possibilities in the way of developing the use of by-products will offer almost unlimited opportunities for the technical dairy expert in the near future.

The type of man now in demand, and the one that will apparently be wanted in the future, is one thoroughly grounded in chemistry and bacteriology and in the fundamentals of dairy manufactures. With these as a foundation, he can readily master the technical details of the particular industry in which he may be employed.

If the student decides upon this type of work early enough in his college career, he can shape his course to the end that he will be reasonably well qualified upon graduation. However, for reasons previously discussed, most students approach the end of their college course before deciding upon the line in which they wish to specialize. For these a year of intensive specialized study such as graduate work makes possible a desirable means of obtaining the technical training needed as a foundation for success in commercial dairy-products work.

The student should appreciate, however, that no amount of study, either undergraduate or graduate, will take the place of practical experience in the particular phase of the industry in which he expects to work. A thorough technical education merely furnishes the foundation upon which a successful career may be built. A young man, regardless of the amount of schooling he has had, should expect to start in a very modest way. If he is made of the right stuff he should advance rapidly to a position of usefulness and responsibility.

Chairman PEARSON. If I am not mistaken, we passed over one paper because the author who has come across the seas was not in the room at the time. He has now arrived and if there is no objection he will be presented by our honorary chairman, Doctor Isaachsen.

Honorary Chairman Isaachsen. I beg to present Mr. V. E. Wilkins, of the intelligence department, Ministry of Agriculture and Fisheries, England, who will speak on "The status of dairy education in England and Wales." [Applause.]

Mr. V. E. Wilkins. Mr. Chairman and gentlemen: I apologize in the first place for not being here at the beginning of this morning's session, but it was the first opportunity for a good night that I have had since I left England, and I took advantage of it. [Laughter.]

I would like to make one or two introductory remarks with regard to the title and the length of the paper. We were asked by the program committee arranging the program of the congress to supply a short paper on the status of dairy education in England and Wales, which would be part of the symposium, so it is said, dealing with that subject.

We understood by the word "status" that the program committee wished to know how dairy education was organized in England by the central authority and, secondly, what place it had in the general scheme of agricultural education.

On that assumption this paper was written. It, therefore, deals entirely with administrative matters, and it does not purport to be a description of the methods by which education is carried out in my country.

I make that explanation because I noticed that several of the papers which have been read to you this morning have dealt with methods of education, and I would like to emphasize that this paper does not purport to touch that question.

Secondly, on the subject of the length, I propose to make my remarks exceedingly brief because the morning is already far advanced and you will wish to have time to discuss the numerous interesting papers which we have heard.

THE STATUS OF DAIRY EDUCATION IN ENGLAND AND WALES.

V. E. Wilkins, B. Sc., assistant principal, intelligence department, Ministry of Agriculture and Fisheries, London.

The funds provided by the Government for the assistance of dairy education in England and Wales are administered by the Ministry of Agriculture and Fisheries. It should be made clear, however, that the ministry has itself no powers to provide any form of education. Its functions are limited to aiding those aspects of agricultural (including dairy) education which it thinks desirable to encourage and assist by Government grants. The responsibility for the actual provision of such education rests with the local education authorities for the various counties, or with the governing bodies of agricultural colleges and university departments of agriculture.

The interest shown by the Government in agricultural education has increased very largely during the past decade. Thirty years ago the amount of Government money available for aiding agricultural education was negligible. Then, through the fortunate coincidence that the then Chancellor of the Exchequer found himself with a surplus of funds at the end of the year, local committees in the various counties were empowered by Parliament to use this money for the provision of technical instruction. The money came from excise duties on spirits and was therefore known as the "whiskey money." Although many changes in the relations between the State and these local committees, both administratively and financially, have taken place since that time, it is only recently that the "whiskey money" has been entirely diverted from the provision of local agricultural education and used for other purposes.

Government grants in aid of agricultural education provided by the local committees referred to above (as modified by subsequent acts of Parliament) remained very small so recently as 1919. For the five years ending March 31, 1919, the average annual Government grant for county agricultural education in England and Wales was about £25,000, including both capital and maintenance grants. On April 1, 1919, however, a new and much more liberal scheme of Government aid was brought into force. This scheme is still in operation, and under it the Ministry of Agriculture is empowered to pay at least two-thirds of the cost of all approved schemes of agricultural education carried out by the local education authorities in the various counties. On certain items of expenditure the rate of grant is as high as 80 per cent, and the all-round rate at present stands at 67 per cent of the total maintenance expenditure. In addition, capital expenditure, e. g., on the provision and equipment of a farm institute, hostel, or dairy, is aided by the ministry to the extent of 75 per cent. In respect of the financial year ending March 31, 1922, the Ministry of Agriculture paid to local education authorities a sum of £213,086 in aid of a total expenditure of £313,585 incurred by them on the provision of agricultural education. This included capital grants of £32,119 in aid of expenditure of £42,825.

In order to qualify for grants from Government funds, local education authorities are required to submit their estimates and schemes of work to the ministry before expenditure is incurred. As the circumstances in the various counties vary widely, the ministry makes no attempt to thrust cut-and-dried schemes upon the local authorities, but leaves them, generally speaking, a very large measure of discretion as to the particular schemes which they adopt in their own areas. From the national point of view, however, it often happens that a scheme of activity may usefully be devised at headquarters and commended strongly to the attention of local education authorities in the country areas. This leads us to the consideration of dairy education as a special part of the general scheme of agricultural education, to which reference has been made above. Certain national movements, such as that in favor of the production of cleaner milk, which is so much to the front to-day, do require the influence of a Government department in bringing home to the various local authorities the need for instruction and propaganda along particular lines. Mainly for this purpose, the education department of the ministry, which is responsible for the administration of all Government grants in aid of agricultural education, has at its disposal the ministry's dairy comissioner, Mr. J. F. Blackshaw, O. B. E., on whom rests the responsibility for ensuring that, so far as possible, an efficient system of dairy education is carried out in the country. Mr. Blackshaw is reading to this congress a paper on the methods adopted in England and Wales to convey education and the principles of cooperation to the farmer, and in that paper he will outline the various schemes adopted by local authorities, which it is his province to encourage, supervise, and, in some instances, to initiate. For the purpose of my own paper, therefore, it will be sufficient to say that in this work, Mr. Blackshaw receives the assistance of a number of inspectors, who are specially qualified in dairying, and he is also able to make use of the general inspectorate organization of the ministry, under which the country is divided into six inspectorial areas, each under the general charge of a divisional inspector, who has under him a staff of inspectors specially qualified in particular subjects.

It is impossible to say precisely how much money is spent by local authorities in England and Wales on the provision of dairy education. It can only be stated that this aspect of education forms a very valuable and increasingly important part of the general scheme which is now in operation. In 45 counties out of 61, one or more dairy instructresses are employed by local authorities, the number of instructresses varying, of course, with the importance of dairy farming in the county.

Before passing to the agricultural colleges and university departments, which provide higher education in dairying, a brief outline of the general educational scheme in operation in the country may be given. The counties of England and Wales are grouped round one or other of the higher agricultural education institutions; thus each county finds itself in a " province " served, as regards higher agricultural education, by an agricultural college or a university department of agriculture. There are, at present, 11 of these provinces.

The counties grouped round each provincial institution usually contribute to the funds of the latter, and thus there is established a close connecting link, which is to the mutual advantage of both parties. On the one hand, the county, through its local education authority, supplies the raw material to the college in the form of intelligent boys or girls, who have shown a special aptitude for proceeding further with their education; in many cases, these boys or girls are sent to the college by means of scholarships granted by the local authorities. On the other hand, the lecturers at the college are available for advising farmers in the counties supporting the college, on technical questions which may be outside the scope of the county staffs. Further cooperation between the two parties to this partnership is secured by periodical conferences held at the college, at which the principal members of the local staffs meet with the college lecturers and discuss common problems and plans of action. Further, the colleges normally possess on their staff specialists in certain scientific subjects (e. g., plant pests), who spend very little time at teaching, but devote their attention almost entirely to research work into local problems, and thus are particularly valuable as advisers to farmers in the area. Generally also, the colleges serve as an important connecting link between the national research institutes and the farmers.

The short courses of dairy instruction (traveling dairy schools, etc.) provided by local education authorities lead up to longer courses of, say, three or four months' duration held mainly at farm institutes (also maintained by local authorities), and these in turn lead to long dairying courses at the agricultural colleges or university departments of agriculture, which prepare for the national diploma in dairying. This "dairy education ladder" has, however, been more fully described in Mr. Blackshaw's paper. One provincial college, in particular, namely, the University College, Reading, is distinguished by the special attention which is paid to dairying, and it has the advantage of being associated closely with the National Institute for Research in Dairying, which is represented at this congress by two members of its staff, Dr. Stenhouse Williams and Captain Golding.

It is again impossible to say precisely what amount of Government aid is provided for higher education in dairying. Government maintenance grants to agricultural colleges are fixed grants for a term of years, and cover all aspects of the agricultural education work of the colleges. At present, £46,500 per annum is being paid by the Government in the form of maintenance grants to the provincial institutions. This is exclusive of the grant in aid of the research work carried out at the Reading Institute, which, for the academic year 1922–23 has been fixed at about £8,000.

This paper would not be complete without a reference to a special fund which has recently been made available for assisting agricultural education and research in Great Britain. When the corn production acts of 1917 and 1920, under which subsidies for certain cereals were guaranteed to farmers, were repealed by the Government in 1921, a fund of £1,000,000 was set aside for assisting agricultural development. Of this amount, £850,000 was allocated to England and Wales to be spread over a period of five years. While it is not possible to say how much of this sum will be used for extending dairy education, it may be stated that considerable prominence has been given to this subject, and the provision of funds on such a comparatively lavish scale will, it is hoped, make possible an important advance in the scheme of dairy education and research at present in operation.

Chairman Pearson. Ladies and gentlemen: What will be your pleasure? We have perhaps 45 minutes before it would be time to adjourn. Will you call for some paper which has not been read? Will we ask the secretary to read it? Unfortunately a number of our very prominent friends in foreign countries are not here, and they are doing a splendid work. We in America have great respect for the work that is being done in other countries. Do you wish to call for one of those papers or more than one, or take the time for discussion of papers which we have heard? What is your pleasure?

We have interpreters here to assist us in the discussion so that everyone should be able to understand what is said. There is another alternative. You may adjourn if you desire to do that.

There are many things that could be said. I could call some of you by name and start a discussion which would be interesting, but I would like to have you decide what we shall do to fill the remainder of the time, if you remain for that purpose.

Mr. Wilkins. Perhaps Professor Fascetti's paper might be read, Mr. Chairman.

Chairman Pearson. Mr. Wilkins makes the suggestion that the paper entitled "Cheese-making instruction in Italy," by G. Fascetti, director, cheese experiment station, Lodi, Italy, should be read. This paper is here in the French language. The secretary is unable to read French and give us the English translation of it. It may be that some one can do that. Could you, Mr. Wilkins?

Mr. Wilkins. No.

Chairman Pearson. Then we shall be denied the privilege of hearing this paper unless some one will volunteer to present it. We will, of course, have it in full when the proceedings are printed.

Has anyone else a suggestion to offer? If not, those remaining papers whose authors are not present will be read by title.

(Adjournment.)

(Papers read by title):

DAIRY INSTRUCTION IN AUSTRIA.

Willibald Winkler, Ph. D., Agricultural College, Vienna, Austria.

There is a school for dairy science held in conjunction with agricultural bacteriology at the Agricultural High School in Vienna. The lectures (two a week) are compulsory, and dairy science is a subject for State examination. The school (Dr. W. Winkler, principal) maintains a laboratory for investigation and research of dairy practice, but does not have a barn or dairy.

At the present time Austria does not have a single school equipped for the technical training of dairy personnel. Nor is there any dairy inspector in any of the Austrian agricultural districts. Vorarlberg, Tyrol, and Kärnten each have one dairy instructor.

There was a cheese school connected with the lower agricultural schools in Rotholz near Innsbruck in the Tyrol, but this is not in operation at the present time. An earlier cheese school at Doren has survived the war. For practical instruction in the Tyrol there is a herdsmen's school at Imst.

Dairy-science instruction is also undertaken, of course, in the agricultural schools, especially for girls of the farm and household management classes, in Klagenfurt and Kärnten. Necessary instruction in dairy science by means of journeymen's courses is undertaken in some of the farming districts such as Tyrol, Vorarlberg, Kärnten, and Oberösterreich.

The Dairy Society of Austria is making an effort to bring into existence a school for instruction and research in dairying that has been provided for by Parliament for three years.

DAIRY INSTRUCTION IN NORWAY.

Kr. Støren, professor in dairy technology, Norwegian Agricultural College, Aas, Norway.

A. THE LOWER DAIRY INSTRUCTION.

The first dairy schools in Norway were founded by the Royal Society for Promoting the Welfare of Norway, a private agricultural association, in 1867, and were intended for the education of women butter makers. The instruction consisted of practical exercises in a course of one to one and a half years. The importation of the centrifuge system late in the eighties brought a revolution in dairy management. There was necessity for an increase of professionals, not only women but also men, and a greater claim was laid on their theoretical instruction. The number of dairy schools therefore had to be increased and theoretical instruction was given greater attention. As the Royal Society for Promoting the Welfare of Norway had not the means to reform the schools as wished, the dairy instruction from 1888 came under the care of the State.

These newly founded schools, of which one was for men, were placed at private butter factories, with courses of one and one-half years. The State partly paid the manager of the factory, who also was the head of the school, and gave the factory a certain amount of money for each pupil. The instruction consisted mostly of practical exercises, in that the pupils by turns took part in all work, but 300 hours were also spent in instruction in science, dairying, and bookkeeping.

With the great development which dairying passed through late in the last century, and in the beginning of this, these schools soon became unsatisfactory, especially in regard to the theoretical instruction. An enlargement of this, however, could only be carried out by decreasing the pupils' practical work in the factories. In order not to weaken this manual skill a new arrangement was introduced; the pupils had to work in advance one or two years in a butter or cheese factory to gain access to the school.

In 1907 this new school arrangement was adopted and has later retained its principle; the schools have, however, by constant internal reforms, tried to keep themselves apace with the demands of the times, as regards both teaching staff and instruction materials. The State now has five dairy schools.

One school for men, intended for the preparation of dairy managers, affords practical exercises for two years at two private butter and cheese factories, approved by the State Department of Agriculture and under the supervision of the principal of the school. Then theoretical instruction is given in a course of 10 months with about 1,000 hours. To gain admission to this course the apprentice has to pass an examination in Norwegian, arithmetic, history, and geography.

The instruction in the school covers: Norwegian, mathematics, science, cheese and butter making, animal husbandry, mechanics, building construction, commercial science, bookkeeping, laboratory exercises, and drawing. The school closes with an official examination.

During his apprenticeship the student receives a small salary from the factory in which he works. At the school the instruction is free and the State pays maintenance expenses for some of the pupils.

Four schools for women.—These schools are both practical and theoretical, and last 15 months. They are placed at well-known private butter factories. The principal of the school and the instructors are partly paid by the State. At least one year's practice in a butter or cheese factory and a good grammar school foundation are required for entering this school. By turns the pupils take part in all the work and receive a theoretical instruction, of about 600 hours, which consists of Norwegian, arithmetic, bookkeeping, science, butter and cheese making, animal husbandry, and laboratory exercises. The school closes with an examination.

The instruction and maintenance at the school are free. The State pays the factory a certain amount of money for each pupil.

B. THE HIGHER DAIRY INSTRUCTION.

Before 1899 there was no higher school for dairy education in Norway. The young men who wanted to receive greater knowledge within their profession had to go abroad to study. In 1899, however, a dairy division was started at the Norwegian College of Agriculture which was especially intended for the education of dairy advisers and instructors. Two years' practical work, examinations from the lower dairy school for men, and examen artium (answering to a two years' college course in letters and science in America) or a preparatory course of one year in languages and mathematics, is required for admission to the college.

The college education covers lectures, exercises, and excursions, and lasts three years.

The first year (September to June), lectures in the following subjects are given: Mathematics, physics, chemistry, botany, zoology, anatomy, physiology, heredity, sociology, surveying, and drawing. The second year: Special dairy bacteriology, dairy chemistry, technology, management of dairy plants, dairy hygiene, animal husbandry, mechanics, building construction, history of agriculture, law, laboratory work, and drawing. The third year: History of dairying, pedagogy, heating and cooling technology, laboratory and technical exercises, and the designing of plans for factory construction.

Instruction is free. Only certain fees have to be paid for access to the laboratories, examinations, etc.

C. SPECIAL COURSES.

With a grant from the treasury, a special course is yearly held, traveling among the lower schools. Every one who is interested in dairying has access to these courses. Lectures are given on practical subjects in the industry, and experts give demonstrations in the factory about butter and cheese making.

D. DAIRY INSTRUCTION IN THE AGRICULTURAL SCHOOLS.

Butter and cheese making was previously a very important subject in the instruction at the agricultural schools, but at the end of the last century it was almost entirely taken out, and only in the very latest years has the subject been readopted in the ordinary instruction, but not to the extent which must be considered justified and necessary.

INSTRUCTION IN DAIRY SCIENCE IN THE AGRICULTURAL COLLEGE AT WAGENINGEN.

Boke van der Burg, professor, Agricultural College, Wageningen, Holland.

Tuition at the agricultural college at Wageningen has for its object the training and preparation of its students for the independent study of agricultural science, and for the exercise of social professions that require education in that science.

The higher agricultural tuition comprises, together with the study of horticulture and forestry, the study of agriculture both in tropical countries and in the temperate zones, more especially in the Netherlands. Only students of the latter branch attend the college courses in dairying.

The diploma of agricultural engineer is conferred upon such students as have completed their studies in the agricultural college, which normally take five years' time. The agricultural engineer, after having made and defended a dissertation, may take his degree as doctor in agricultural science. To obtain that diploma a student must submit consecutively to three examinations: (1) The propaedeutical examination, (2) the candidate's, or bachelor's, and (3) the engineer's examination.

No matter where the examinee may have mastered the knowledge required, every one is admitted to the examinations in the agricultural college, provided he be possessed of a final diploma from the "Hoogere Burgerschool," a five years' course (of which the nearest equivalent in America is the high school), or of a certificate of sufficient preparation for one of the universities, or for the technical high school. Consequently the higher agricultural tuition in Holland is on a level with university tuition.

The propaedeutic examination is the same for all students in the agricultural college, and comprises the following branches:

a. Mathematics (analytical geometry, the elements of differential and integral calculus), and mechanics (elements of applied mechanics, introductory knowledge of the theory of instruments, power machines, mechanical drawing, elements of hydrodynamics, hydrometry).
b. Physics (chapters from the theory of radiation, interference, deflection, polarisation, laws of radiation, solar radiation), and meteorology.
c. Chemistry (general view of organic chemistry, knowledge of the principal organic and inorganic compositions, physical chemistry, qualitative analysis).
d. Mineralogy and geology (the principal soil-constituting minerals and rocks in connection with geological phenomena).
e. Botany (physiology, biology, and morphology).
f. Political economy.

The propaedeutical study takes in all 16 months.

The study of a candidate (bachelor) takes a period of two years; it is split up into four different branches, viz, plant industry, animal husbandry, dairy industry, and economics.

The tuition for the study of a candidate (bachelor) is subdivided into obligatory subjects and optional subjects. In the list below the optional subjects are marked with an asterisk (*). A student who specializes in dairy science is obliged to submit to an examination in the branches appearing in italics. Besides, he may obtain a certifying statement on his diploma to the effect that he has been passed after an examination in any of the other subject matters. Following are the branches of subject matter for a candidate's study:

Cultivation of agricultural plants (farm crop production).
Genetics.
Botanical anatomy.
Technics of cultivation (reclaiming of waste land, drainage, draining of polders and fields).
*Phytopathology and entomology.
*Agrogeology.
Rural Engineering.
Microbiology.
Cultivation of agricultural plants (farm crop production).
tilizers', quantitative analysis).
Stock breeding (natural history, anatomy, knowledge of various breeds, stock judging, health and disease of animals).
Physiology of animals.
*Calculus of probabilities.
Dairy technology.
Agricultural economy and farm management.
Agrarian law.
Economic geography.
*Electrotechnics.
*Agricultural technology.
*Agricultural architecture.

As a consequence of the above curriculum of a candidate's study, all prospective agricultural engineers will have gone through a general agricultural training before they specialize in a definite branch.

After completion of a candidate's study the specialization, which hitherto had been a very practical one, is carried on more forcibly.

As regards the branch called dairy industry, its study includes at present the following obligatory lecture subjects: (1) Dairy science, (2) microbiology, (3) feeding of domestic animals, (4) chemistry of fats, and (5) one additional optional subject. The student's option, however, requires the approval of the college board.

For obtaining admission to the engineer's examination the candidate has to hand in a certificate of having been actively employed in dairy manufacturing work (in a butter and cheese making concern or a city milk plant) for a period of six months at the least.

The tuition in dairy technology and dairy science may be briefly summarized as follows: Lactology, composition and properties of milk; chemical and biological testing of milk; manufacturing of butter, cheese, and other milk products; chemical analysis of milk products and accessory substances used in dairy industry; milk hygiene; city milk supply.

For the theoretical tuition in dairy industry one hour a week is available in the study of a candidate (bachelor) and two hours a week in that of an engineer. Three hours a week are apportioned to candidates for practical experimentation in the laboratory for dairy products, whereas an unlimited number of hours are allowed to such as are reading for their engineer's examination for the purpose of making scientific investigations under the guidance of a professor of dairy science.

Besides, the students are under the obligation of being actively employed for some time in the chemical laboratory and in the laboratory for microbiology.

In the course of the engineer's study the students are called upon to write independently a paper on one or more special subjects, with the aid of literature bearing upon the subject. In this connection it may be remarked that the general library of the agricultural college possesses a pretty complete collection of manuals on milk and milk products in the Dutch, Danish, English, French, German, and Swedish languages; besides it subscribes for the chief professional journals and periodicals in these languages, in all about 40 papers. Moreover, the dairy department possesses besides textbooks, numerous reprints, and reports relative to dairy science and to the manufacture of dairy products.

In the work on stock breeding and dairying the agricultural college has the use of about 30 milk cows; their milk is prepared in the technical department for the manufacture of dairy products. In this department, which as yet is fitted out on a modest footing, various experiments are carried on, and students are given an opportunity to take part in those experiments.

DAIRY INSTRUCTION IN SWEDEN.

Lars Fredrik Rosengren, Ph. D., principal of the Dairy Institute, Alnarp, Sweden.

The aim of dairy instruction is to train people for various kinds of work, more or less expert, in the field of dairying, and it thus includes the education of:

(1) Teachers for scientific or higher instruction and leaders for experimental work.

(2) Consulting experts and teachers for less advanced instruction.

(3) Male practical professionals, i. e., principals or managers of large or small dairies.

(4) Female practical professionals, i. e., manageresses of the smaller dairies.

(5) Female domestic consulting experts and teachers whose duty it is to work for the rational treatment of milk in the home.

The qualification for advanced teaching and research work is a thorough scientific training, and is acquired by passing an advanced examination in science and submitting a test thesis, preferably in chemistry, at the university. In addition there is special training in subjects connected with dairy practice, which coincides with that given in the education of consulting experts, and takes place at the Dairy Institute at Alnarp.

The training of consulting experts includes, in addition to the necessary instruction in dairy practice, a general education in agricultural subjects, but the advanced examination in fundamental subjects of natural science at the university or other college may be excused. The agricultural training consists in the pupil, after passing the matriculation examination or acquiring corresponding knowledge in general fundamental subjects, spending two years in agricultural practice, and then going through a two years' agricultural course at one of the two agricultural colleges in the country. The special education of the consulting expert occupies one year, of which four months are devoted to practical exercises in the instruction dairy, and four months to chemical and bacteriological laboratory exercises. Together with the practical work there is theoretical instruction, and visits to dairies and butter exhibitions in order to study the different types of dairies and to gain practice in the judgment of butter. In addition to the subjects belonging purely to dairy practice, there is instruction in the use of boilers and steam engines, building and architectural designing, and the care of domestic animals, especially with regard to their feeding, inspection, and ailments. The course is concluded by examinations in the different subjects, the solving of simple practical experimental problems connected with laboratory investigations, and the giving of suggestions for the planning and equipment of different types of dairies.

The education of the male dairy staff, i. e., such as are intended to become principals and managers of dairies, also takes place at the Dairy Institute at Alnarp, and builds on a well-attested general school education and also, as a rule, several years' experience in dairy practice. On private initiative the last mentioned feature has been so organized that arrangements have been made with a number of approved model dairies which have undertaken to exercise a certain control over those learning the practical work and attesting on their behalf. The first year is thus devoted to determining whether the worker is, generally speaking, suited for promotion to further instruction. If this is the case, he is promoted to a three years' course of practical instruction, i. e., one year as a practical machine mechanic, one year as a practical butter maker, and one year as a practical cheese maker, after which he may apply for admission to the dairy college. The training here extends over one year. Practical exercises go together with theoretical instruction, all the pupils having in turn to carry out all the tasks in the instruction dairy under the direction of the teaching dairymen and the dairy manager. The last-mentioned person is also the teacher in milk treatment and dairy technique; about two to three hours every day are devoted to theoretical instruction. Laboratory exercises take place in connection with the practical work. In addition to the subjects belonging purely to dairy practice, instruction is given in writing, calculation, bookkeeping, the use of boilers and steam engines, building and design, and in the feeding, care, and ailments of domestic animals.

The education of female dairy staff or manageresses for the smaller dairies takes place at seven approved private dairies which are managed and equipped on model lines, situated in various parts of the country; it builds on a general school education and dairy practice. The latter is aquired at a certain number of dairies, which, being subsidized by the State, undertake to receive practicing pupils. The college course itself lasts one year. The pupils have to carry out all the tasks in the teaching dairy under the direction of the dairy manageress, and also to take theoretical instruction, which is given partly by the nearest resident consulting expert, provided that he is not prevented from doing so by other duties, and partly by the dairy manageress.

The education of female domestic consulting experts and teachers for the colleges of domestic economy situated in various parts of the country is carried out at the colleges of domestic economy at Rimforsa and Brogarden, where a two years' course is given, including practical and theoretical instruction in the treatment of milk, as well as in all activities connected with rural domestic work. Among the requirements for entrance into these colleges of domestic economy at Rimforsa and Brogarden are a thorough and well-attested knowledge of rural domestic practice and a certificate from a higher grade girls' school.

All dairy instruction is subsidized by the State. For the course for consulting experts at Alnarp, 6 pupils at the most are accepted, and for the course for dairymen, at the same place, 20 to 30 pupils. The pupils' fees for these courses correspond approximately to the cost of their food. In each of the courses there is a free scholarship. In each of the women's dairy colleges about 8 pupils are accepted, all of whom study, free of charge, and receive some support in addition.

THE DAIRY INDUSTRY OF DENMARK: EDUCATION AS THE TRUE FOUNDATION.

N. KJAERGAARD JENSEN, professor of dairying at the Royal Veterinary and Agricultural High School, Copenhagen.

When speaking of the system of dairy education as pursued in Denmark, one must consider it in two parts, namely, the junior and the senior divisions. The junior provides factory and creamery managers who possess sound practical knowledge of the duties underlying the successful manufacture of dairy products; and the senior division is devoted to the training of students who will become graduates in dairying and specialize as lecturers in dairy colleges.

The junior division can again be divided into practical and theoretical instruction. Practical training was for many years entirely free and unrestricted in its application. A factory or creamery could have as many apprentices as it chose, and the period of apprenticeship was not stipulated in any way; neither was it compulsory for the apprentice to accept tuition in butter and cheese making, or for the instructor to provide the necessary training in this and other branches of dairy work.

The defects of this education attracted the attention of those having the welfare of Danish dairying at heart, and more particularly the Association of Dairy Managers, who, after an examination of the defects, decided on improvements. In 1910 the directing board of the association took the initiative into its own hands, and prepared a scheme embodying a four-year period of apprenticeship The scheme was promptly recognized as a forward step and heartily approved by the industry. No compulsion, however, was applied at first to bring the training under the direct supervision of the association, but from 1918 the four-year apprenticeship became compulsory, with the association as the governing body. The rules applied to the teachers of this subdivision of practical education may be interpreted as follows:

Each member of the Association of Danish Managers undertakes to instruct an apprentice in all practical dairy factory or creamery work, also in accountancy and recording, and the instruction is to be thorough and applicable to the profitable management of the various departments of dairying. It is also necessary that the instructor shall place at the disposal of the apprentice up-to-date literature on dairying, in order that he may exercise to the fullest extent such combined opportunities.

During the first year the full routine of work has to be done. The second year is devoted to buttermaking, the third to cheese making, and in the fourth year the apprentice learns the mechanical side of his training such as machinery, heating, cool temperatures, etc. It is not necessary for the apprentice to go through the four years' work in the order mentioned, but it is essential to include the branches of training referred to in the four years' course; also the apprenticeship must be done in two and not more than three first-class dairy factories or creameries. During the last three years the apprentice has to undertake the accountancy as well as all milk and produce records, and prove his competency in business transactions in no light manner.

At the close of the four years' apprenticeship, the future manager receives "a certificate of apprenticeship, signed by the board of the association."

As already stated, previous to 1918 every factory or creamery had the right to have as many apprentices as it chose, but from that year it was agreed by all the dairy organizations that the number of apprentices at each factory or creamery should be limited to the proportion of experienced managers, to insure at any given time efficiency in manufacture.

THEORETICAL EDUCATION.

Theoretical education was inaugurated in 1887 by the late founder and president of the Ladelund Agricultural College, Mr. Niels Pedersen, who instituted a five-month course of theoretical education for future managers. The syllabus was chiefly devoted to chemistry, physics, management of domestic animals, and machinery, and was continued in conjunction with the agricultural course till 1910. It must be mentioned here that in 1892 also a shorter course was founded with a three-month educational program, which was later extended to four months. Besides the above-mentioned dairy college, Mr. Jorgen Pedersen, president of the Dalum Agricultural College, in 1889 also commenced a special dairying course beginning with a three-month tuition and later prolonging same to four months. All these courses continued till 1910, when the dairy associations intervened, owing to the rapid development of the dairy industry. They approached the two existing colleges with a suggestion that a more comprehensive and thorough system of education was required, and it was agreed to have the period of training extended to eight months, namely, from September 1 to the end of April. This arrangement was brought into effect in both colleges from September 1, 1910, and is still in force. It was also decided to put the system of education in both colleges on an equal footing and have the students examined in every subject once a year in the presence of a body of controlling delegates representing the Danish Government and dairy organizations. The students in these colleges are instructed in theoretical and practical chemistry and bacteriology, physics, mangement of domestic animals, machinery, commercial calculations, and accountancy; also attention is given to writing, arithmetic, drawing, and gymnastics.

The working day in such a college is arranged as follows: Lectures from 8 a. m. to noon, with 10 minutes' recreation between each lecture; from noon to 2 p. m. is allowed for dinner and recreation, and the lectures are continued from 2 to 6 p. m. In the evening the students must read and prepare themselves for the next day. They are enrolled to attend every lecture; and should something prevent a student from doing so, an instructor or the director of the college must be informed of the cause.

ADVANCED EDUCATION.

Up to the year 1904 all students who desired to become graduates or lecturers in dairying received the same theoretical education as an agricultural student, at the Royal Veterinary and Agricultural High College in Copenhagen. The syllabus comprised chemistry, physics, geology, botany, zoology, anatomy, land mensuration and leveling, drawing, mathematics, cultivation of plants, horse breeding, management of domestic animals, agricultural bookkeeping, and general agriculture, as well as agricultural chemistry. The normal course continued about twenty months and two examinations were held. The first examination covered general education and took place after about nine months' attendance; the second examination was devoted to the remaining subjects and was held at the end of the course.

On September 1, 1904, a supplementary course for agricultural students wishing to graduate in dairying was founded. To attend this course it was compulsory for the student to possess sufficient knowledge of German and English to enable him to read books written in these languages.

Before being admitted to the examination following the last course, the student has to pass, first the agricultural examinations, as well as show evidence of high character. The period for this course is also 20 months, and includes the following subjects: Physiology, agricultural chemistry, pathology, management of domestic animals, bacteriology, rural law, political economy, practical work in chemistry and bacteriology, and also drawing. The course is followed by an examination.

But the dairy associations were not entirely satisfied with the arrangement that a dairy student was obliged to follow a training in agriculture before beginning his special studies in dairying. Necessary steps were undertaken by the Danish Cooperative Dairy Association to have the above arrangement altered. The Royal Veterinary and Agricultural High College in Copenhagen immediately announced its willingness to support the association. The position was considered and new rules were issued to take effect September 1, 1921.

The new course extends over two and two-thirds years; however, before passing the examinations the student must go through a practical education to be approved by the Royal Veterinary and Agricultural High College. This practical work is expected to take at least four years after the student has reached the age of 15, or three years after he has attained his seventeenth year.

The period of education is divided into two parts; the first continues for 18 months, and the following subjects are studied: Physics, meteorology, chemistry, geology, botany, microbiology, laws of heredity, zoology, anatomy and physiology of domestic animals, political economy, and agricultural chemistry; practical work in physics, chemistry, and bacteriology, also drawing is taken. The second part continues about 18 months, and deals with the treatment of animals, management of dairy industry, dairy chemistry and bacteriology, also geology, pathology, and practical work in machinery, housebuilding, general agriculture, agricultural chemistry, dairy chemistry, and dairy bacteriology.

The first graduate in dairying, educated under the new rules, should complete his studies on the 1st of May, 1924.

Before closing this short contribution, it must be mentioned that also in the Copenhagen Polytechnicum, students studying to be factory chemist-engineers receive a certain dairying education.

DAIRY INSTRUCTION IN THE NETHERLANDS.

K. H. M. van der Zande, Ph. D., inspector of agricultural instruction, The Hague.

FIRST FORMS OF PROFESSIONAL INSTRUCTION IN BUTTER AND CHEESE MAKING.

About the year 1888 instruction in butter and cheese making was realized for the first time in our country. This was before the time that dairying in factories was put into practice, or at least, was in its first stages.

It is therefore easy to understand why the first teaching purposed was improvement of butter and cheese making at the farm. At the institution " de Leerhoeve voor Zuivelbereiding," i. e., " school farm for butter and cheese making," at Oudshoorn, it was resolved that it should be in the first place a " model dairy farm," at which the pupils should be taught the perfect practice, and next that theoretical instruction should be given in natural sciences, especially chemistry, and, further, in everything that was deemed necessary for a thorough understanding of the processes going on in dairy matters.

This institution could not maintain its position and was discontinued after existing but a short time. About the causes leading to this failure only suppositions can be suggested. At any rate, it appeared that a practical theoretical school of this kind was, at that time, not in demand in our country.

A little later, about 1889, the " Vereeniging voor Vakonderwijs in de Zuivelbereiding," i. e., the "Association for Professional Instruction in Butter and Cheese Making " was established in Friesland, which founded a school. This school was, in some degree, cast in the same mold as the first mentioned. It was also a practical and theoretical school with a dairy factory, which, however, was better equipped for butter and cheese making and which put into practice the methods then adopted at the great farms in Schleswig and Denmark. This school existed from 1889 to 1900, just at the time when the change of dairy farming into manufactural dairying had come about in Friesland.

Nor could this school maintain its position; for want of pupils it was discontinued in 1900. Different causes are sure to have cooperated to its failure, and, perhaps, one of these causes is that the school gave too much attention to dairy farming (which was, indeed, gradually disappearing) and too little to dairy manufacturing.

THE GOVERNMENT DAIRY SCHOOL AT BOLSWARD.

For some time special professional instruction in butter and cheese making fell into abeyance in our country, till, in 1904, it was resolved to establish a Government dairy school, which is still in existence. At this school the system of a combination of practical and theoretical instruction was abandoned. To be admitted to this school it would, henceforth, be required that the applicants should have worked a certain time at an ordinary dairy factory, and that they should be practically at work, for some time, during the course of the school.

Besides, the teaching at the school aimed at preparing the pupils for dairy manufacturing, including an education to become manager of a dairy factory. It became more and more evident that in a large part of our country dairying, at any rate butter making and mixed butter and cheese making, was moving in the direction of specialization at factories, and consequently there would be an increasing want of well-informed managers of such factories.

The school has now been in existence about 19 years and is regularly attended by a moderate number of pupils. In this form it appears to supply a want, and it can send out, every year, a moderate number of young men, who have been properly prepared to act as managers after some further introduction into practice.

In the course of some years the educational curriculum of the school has been supplemented a little and the entrance requirements both with regard to examination and to practice have been made slightly more difficult. At present the situation is as follows:

Theoretical instruction at the school is given in the following subjects:

a. Mathematics.
b. Physics and mechanics and knowledge of implements.
c. Chemistry.
d. Dairying.
e. Bacteriology.
f. Scientific system of feeding and hygiene of cattle.
g. The elements of political economy.
h. Bookkeeping and commercial arithmetic.
i. Knowledge of laws.
k. Economical geography.
l. Dutch language and commercial correspondence.
m. German language and commercial correspondence.
n. English language and commercial correspondence.
o. French language and commercial correspondence.
p. Technical drawing.
q. First aid in industrial accidents.
r. Physical exercise.

Of the subjects mentioned under *m*, *n*, and *o*, at least one, at the option of the pupil, must be studied; the other subjects are obligatory for those wishing to obtain the final certificate of the school.

The following will give further information about the extent and kind of teaching.

TIME-TABLE.

Subjects.	Number of hours per week.		Subjects.	Number of hours per week.	
	First class.	Second class.		First class.	Second class.
Dairying	2	1	French commercial correspondence and professional literature	2	1
Bacteriology	2	0	German commercial correspondence and professional literature	2	1
Chemistry	3	2	English commercial correspondence and professional literature	2	1
Physics and mechanics	3	3	Technical drawing	2	2
Mathematics	2	1	First aid for accidents (professional)	0	1
Scientific system of feeding and hygiene of cattle	2	1	Physical exercise	1	1
Bookkeeping and commercial arithmetic	3	3	Practical exercises	2	4
Knowledge of laws	1	1	Total	32	32
Political economy	1	1			
Economical geography	1	1			
Commercial correspondence in Dutch	1	1			

CURRICULUM.

Dairying.—First class, two hours a week and practical exercises; second class, seven hours a week and practical exercises.

First class: Main constituents of milk; determination of specific gravity and fat percentage; milk production; control of the milk and dairy products; complete composition and qualities of milk; different methods of analyzing milk; detection of adulteration; abnormalities of milk; examination of abnormal milk; milking, treatment of the milk at the place of production and transport to the factory; butter making; skimming according to different systems; centrifugal skimming; practical exercises.

Second class: Butter making, treatment of cream, churning, further manipulation of butter, qualities and composition, defects, test, conservation, and packing of butter; cheese making, cheese ripening, defects of cheese; properties and use of the by-products of butter and cheese making; sale of milk for direct consumption; manufacturing of milk for children; equipment of a dairy factory; how the factory must be managed, technical bookkeeping, different ways of payment for milk, different charges, sale of the products; butter act, butter control; butter and cheese making as a branch of agriculture, different directions for butter and cheese making; main points in the history of butter and cheese making; practical exercises.

Bacteriology.—First class, two hours a week.

Historical introduction; morphology, cytology and biology of lower organisms; breeding methods; different kinds of bacteria, ferments, and molds important for butter and cheese making; pathogenic germs; Pasteurizing; sterilizing; means of disinfection; enzymes, bacteriological and biological milk examination.

Chemistry.—First class, three hours a week and practical exercises; second class, two hours a week and practical exercises.

First class: Physical and chemical phenomena; discussion of important elements; combination phenomena; oxides; sulphides; halogenous combinations; acids and bases; phenomena of reduction and displacement; salts; chemical laws and theories; how these are applied to analysis of salt; practical exercises.

Second class: Organic chemistry, carbohydrates, alcohols, aldehydes, organic acids, ethers, esters, fats, hydrates of carbon, aromatic substances, and albumens. These combinations will be amply discussed, as they are of great importance in butter and cheese making. Repetition and extension of what has been taught. Practical exercises and examination of substances important to butter and cheese making.

Physics and mechanics.—First class, three hours a week and practical exercises; second class, three hours a week.

First class: General physical qualities of the bodies; equilibrium and motion of liquids, more elaborate discussion of specific gravity and determination of it; equilibrium and motion of gases, more elaborate discussion of pumps and manometers; heat, expansion of bodies when heated and application of the same, phenomena occurring by change of state, measuring of heat quantities, origin and transmission of heat; principles of mechanics, equable, varying, and circular motion; composition and resolution of forces; central forces; center of gravity in connection with equilibrium; simple mechanical powers, lever, pulley, windlass, inclined plane and screw; elaborate discussions of cheese presses and measuring and weighing instruments used in dairying; practical exercises.

Second class: Elaborate discussion of the steam engine and other motors, boilers, transmissions; refrigerators; Pasteurizing apparatus; main points of electricity, especially with a view to electric lighting and propelling force.

Mathematics.—First class, two hours; second class, one hour a week.

Repetition, amplification and continuation of what was formerly taught in connection with what is necessary for tuition in physics and mechanics.

Scientific system of feeding and hygiene of cattle.—First class, two hours; second class, one hour a week.

First class: The body of cattle and the functions of the different organs; maintenance of animals, stable arrangement; some cattle diseases, veterinary government supervision in our country; constituent parts of the animal body; ingredients of the food.

Second class: Digestion of the food and transmutation of it in the body; food ratio; feeding stuffs; feeding of milk cows when turned out to grass; stable feed in transition periods.

Bookkeeping and commercial arithmetic.—First class, three hours; second class, three hours a week.

First class: Bookkeeping by single entry; discussion of the theory of bookkeeping by double entry; use of memorandum book, journal and ledger; balancing of accounts; balance account and profit and loss account; entries of bills of exchange, consignments and commission business; introduction into the use of auxiliary books. The matter learned applied to the bookkeeping of a dairy factory, for account of one person; commercial arithmetic; calculations in the goods trade in general and that in the butter and cheese trade in particular; interest; account current, average values.

Second class: Bookkeeping on the monthly method; how depreciations and reserves are dealt with; bookkeeping of partnerships and cooperative associations applied to dairying; administration of branch concerns; commercial arithmetic; division of profit and loss; something about our monetary system and that of our neighbors; stocks and bills of exchange.

Knowledge of laws.—First and second classes, one hour a week.

First class: Elements of the Dutch frame of government; the principal provisions of our Civil Code, particularly concerning right of contract, labor contract, and evidence.

Second class: Elements of merchant act, bankruptcy act, cooperation act, public health act (embracing all measures for the removal of nuisances), act concerning public safety, labor act, accidents act, act concerning professions and steam engineering act.

Political economy.—First and second classes, one hour a week.

First class: History of political economy; main principals of exchange value; production and division.

Second class; Mediums of exchange; banking and credit system; some important questions of political economy.

Economical geography.—First and second classes, one hour a week.

First class: Introduction; the earth as a celestial body; division of land and water; climate; the soil; the inhabitants of the earth; natural products; location of metals; collective products; products of cattle breeding; agricultural products; estate farming; industry.

Second class: Traffic by sea; ports and routes by water; railway traffic; commerce, colonial powers; repetition and extension of some parts; in particular, discussion of the world's production of and trade in dairy products.

Dutch commercial correspondence.—First and second classes, one hour a week.

Introduction into commercial correspondence; letter writing; correspondence concerning buying and selling; reading commercial subjects.

Second class: Correspondence concerning buying and selling, transport, insurance, and payment; writing of invoice bills, bills of exchange, circulars, letters concerning application for a situation, inquiry, and recommendation; correspondence in particular relating to dairy trade and dairy factory.

English commercial correspondence and professional literature.—First class, 2 hours; second class, one hour a week.

First class: Introduction into commercial correspondence: circulars; letters of recommendation and credit; requests for information; answers to advertisements; shipping affairs; commercial letters proper (purchase, sale, consignments c. a.); continuation of the preceding, and in particular correspondence about money affairs (credit, bills of exchange, summons for payment, insurance, account current).

Second class: Testimonials; notes; market reports; general repetition; letters relating especially to the pupils' profession.

Reading about dairy subjects in the two classes.

French commercial correspondence and professional literature.—First class, two hours; second class, one hour a week.

First class: Introduction into commercial correspondence; circulars, recommendations, letters of credit, offers of service, information, consignments, orders and how executed; payments, account current, correspondence with creditors and debtors, bankruptcy, insurance, shipping affairs, agencies.

Second class: Market reports, telegrams, advertisements, models, and formulas; correspendence of a dairy factory with foreign countries.

Reading about dairy subjects in the two classes.

German commercial correspondence and professional literature.—First class, two hours; second class, 1 hour a week.

First class: Introduction into commercial correspondence; circulars, information, recommendations, letters of credit, letters about account current, on money matters, on bankruptcy; every now and then a composition on subjects relating to dairying.

Second class: Export trade; dispatch of goods; insurance, shipping affairs; letters on goods trade; market reports; letters concerning dairying; compositions on the same subject. Something about commercial practice and commercial nomenclature.

Reading about dairy subjects in the two classes.

Technical drawing.—First and second classes, 2 hours a week.

Simple geometrical and projection drawing from sketches, prints, and objects; reading architectural and mechanical drawings.

First aid for trade accidents.—Second class, one hour.

Structure of the human body; first-aid treatment for injuries; practical exercises.

Physical exercise.—First and second classes, one hour a week.

PRACTICAL EXERCISES.

Dairy matters.—(*a*) Examination of whole milk, skimmed milk, milk serum, cream, buttermilk, and whey; fat determination, especially according to the Gerber method; this mehod compared with others (Soxhlett, Gottlieb-Röse, etc.); determination of specific weight; examination of adulterations; determination of the degree of acidity; alcoholic reaction, cooking test, curdling test; fermentation test, dirt determination, enzyme reactions; how to distinguish boiled milk from unboiled milk.

(*b*) Examination of butter and of butter substitutes; determination of the refractometer number; determination of the percentage of volatile fatty acids (Leffmann-Beam method); fat determination according to Gerber and Gottlieb-Röse; determination of the salt percentage; determination of water percentage.

(*c*) Cheese examination; determination of fat according to Van Gulik, Bondzynski, and Gottlieb-Röse; determination of water percentage.

(*d*) Examination of auxiliary substances; salt, water percentage, chlorine percentage; qualitative examination for iron, magnesium, etc.; soda, percentage and purity; rennet, determination of strength, examination in the fermentation apparatus; amyl alcohol and sulphuric acid.

Physics and chemistry.—The practical exercises for these subjects serve principally to prepare the exercise in dairy matters.

Physical exercises.—Weighing with sensitive balances; determination of the specific gravity of liquids with areometers, pycnometers, and Mohr balance, and of solid bodies; controlling measuring and weighing instruments used in the dairy laboratory, and butyrometers; determination of boiling point.

Chemical exercises.—Reactions on metal and remnants of acids important to butter and cheese making; application of it to qualitative examination; quantitative determinations, principally volumetric (alkali, acidi, and oxydimetry) ; in connection with this, making and preparing normal solutions; some analytic determinations of weight; determinations of fat with the extraction apparatus of Soxhlett; determination of nitrogen according to Kjeldahl; examination of norton water, qualitative examination, determination of the degree of hardness, determination of the percentage of organic ingredients, iron determination.

To be admitted to the school it is required that the pupils should be 19 years of age and that they should have been employed for two years at a factory for manufacturing butter and cheese or at a farm butter factory and a farm cheese factory, and that they should be able to produce a certificate, satisfactory to the director, proving that they are conversant with the practice of the profession. The general culture that is deemed indispensable is shown in the following qualifications for entrance:

For arithmetic: Proficiency in ciphering with whole numbers, vulgar and decimal fractions, and in solving problems; knowledge of the metric system.

For algebra: Proficiency in addition, subtraction, multiplication, division, and involution of algebraic expressions, also in fractions and in solving simple equations involving one or two unknown quantities.

For geometry: Proficiency in solving problems about the congruence of triangles, properties of parallelogram, rectangle, square, rhombus, and trapezium, and in making constructions.

For physics: A distinct conception of the simplest physical notions and phenomena and their applications, such as law of Archimedes, specific gravity, levers, atmospheric pressure, thermometers, state of matter, coagulation, liquefaction, evaporation, and condensation.

For botany: Proficiency in the main points of the interior and exterior construction and the feeding and propagation of the higher plants, as well as knowledge of some important families of plants.

For zoology: Proficiency in the main points of the interior and exterior make-up of the body and the circulation of the blood, the feeding and respiration of man, and of the principal domestic animals.

For geography: Knowledge of our country with regard to the provinces with their principal places, the chief routes of communication by land and water; the nature of the soil and the relative business and products; knowledge of our colonies, as to their situation, the islands, and some places and products of the largest islands; knowledge of the different states of Europe and their principal places, mountains, and rivers, as well as some articles of export; a general survey of the other parts of the world, as to their situation, principal countries, and places.

For Dutch: Knowledge of the principal parts of grammar, viz, the kinds of words and parts of the simple and compound sentence, the principal rules of orthography, and the elements of the formation of words, writing a composition without spelling mistakes and mistakes against the language worth mentioning; reading a not too easy piece of prose or of poetry well, and explanation of the same.

For English: Knowledge of the principal parts of the grammar; correct application of the grammar when translating a not too difficult piece of prose or some sentence from Dutch; reading and translation of a simple piece of prose; a proper pronunciation.

For French: Knowledge of the principal parts of the grammar, more especially the conjugation of the verbs (regular and irregular) the past participle, the present participle, the subjunctive; correct application of the grammar when translating a not too difficult piece of prose or some sentences from Dutch; reading and translation of a simple piece of prose and a proper pronunciation.

For German: Knowledge of the principal parts of the grammar, as to the changes in form of the article, the noun, the adjective, the pronoun, the number, the conjugation and use of the verbs (weak, strong, and irregular), the indirect speech, the adverb, the conjunction and the preposition, correct application of the grammar when translating a not too difficult piece of prose or some sentences from Dutch; reading and translation of a simple piece of prose; a proper pronunciation.

Exemptions can be granted to persons holding certificates of schools guaranteeing at least an education which comes up to the above-mentioned standard.

During the course, the pupils of the first class, six weeks in summer, and those of the second class, a month in spring, must be practically at work in a dairy factory; during that period the director of the school remains in touch with them and the manager of the dairy factory issues a statement concerning their work.

The director of the school is a scientifically trained agriculturist, who has had previous experience as a dairy adviser and as a higher official of a cooperative dairy association. The head teacher is an agricultural engineer, who has also studied at the agricultural university. Besides these there are different teachers for the separate subjects, most of whom possess a certificate of secondary instruction. In all there are 12 teachers.

At the end of the second year a final examination is held by the staff of the school in the presence of a committee consisting of three dairy experts and the inspector to the agricultural instruction. From this examination it must appear that the instruction at the school has been successfully followed and assimilated, and that the statement concerning the practical work in the dairy factory is satisfactory. The certificate of the school is given when the grade is satisfactory.

From the preceding account it is clear that at this school the plan is adhered to, that practice must not be learned at school, but at a well-conducted, ordinary practical dairy factory, and that the school, connecting itself as much as possible with practice, furnishes instruction that is essential to understand everything that is done at the factory.

During the time of its existence the Government dairy school was attended by 230 pupils, 164 of whom obtained the final certificate. An average of a little more than 10 young men a year are graduated from the school. These, as we may trust, are properly prepared for the task waiting for them, as manager of a dairy factory and most of whom, certainly, after a transition period, are employed as such.

THE PROFESSIONAL SCHOOL OF CHEESE MAKING AT HOORN.

This school purposes to efficiently prepare young men professionally for cheese makers at North Holland cheese factories. In this Province there exists pretty generally a system of joint cheese factories working in a cooperative manner.

These factories are not large enough to be able to carry the expense of a dairy factory established on a larger scale, because the factory generally restricts itself to the making of Edam cheese and whey butter.

The purpose of the above-mentioned school is to prepare the head cheese makers, who are at the same time technically responsible for the product, in an efficient way for their work.

The practical education is here, too, in an ordinary factory. One of the requirements for admission is that a pupil should have worked for a year as cheese maker at a factory, so that a tolerably important practical exercise has been guaranteed.

At the professional school, instruction is given by the provincial dairy expert and his chief assistant, in the theoretical knowledge of milk and cheese making and the principal parts of butter making, in connection with practical exercises in the examination of the composition of milk and its use for cheese making.

Another requirement for admission is that the pupil should be at least 17 years old and has received lower instruction with success, which must be proved at the entrance examination.

During the theoretical course, which lasts three terms of three months each on two afternoons a week, for two hours, the pupils are always at work at the factory.

During that time they are supervised by the principal of the school and a member of the regulating committee, and must keep books in a technical way. The judgment about these things is taken into account, when at the end of the course, it must be decided whether the certificate for cheese maker can be granted.

The subjects taught at the theoretical lessons are the following:

Composition of milk, qualities of its constituent parts and of the milk itself.
Determination of the Sp. G.; the fat percentage; the dry substance.
Influence on the quantity of milk produce, and the percentage of fat and casein.
Milk suspected of being adulterated.
Microorganisms in butter and cheese making.
Implements and how they must be treated.
Water for the milk and dairy factory.
Milk production and how milk must be treated.
Receiving milk at the factory; control as to quality.
How to get the required fat percentage in milk of which cheese has to be made.
Rennet and how it works.
Coloring matter and its use.
How curdled milk must be dealt with.

Pressing, taking away of the cloth and the border, salting and brining.
Further discussion of cheese ripening.
Additions: Calcium chloride, saltpeter, pure cultures, long whey.
Defects of cheese.
Cheese produce.
Rising to the surface of the butterfat in milk and whey.
Some parts of butter making.

In the first three months subjects 1 to 9 are discussed; in the following three months 10 to 14; and in the last three months the remaining subjects.

Besides the pupils who are following the profession of cheese making, some "auditors" are admitted, who are interested in a proper insight into manufactural cheese making, because, afterwards, when they are farmers, they may, perhaps, be asked to perform the duty of a member of the board of a cooperative cheese factory.

These auditors can obtain a certificate, but not a certificate of cheese maker.

Since the establishment of the school in 1910, 10 courses were held, which were attended by 117 pupils. Ninety-one of these got the certificate.

This school supplies a want in the region where it has been established and is appreciated by the farmers, owners of the factories, as well as by the cheese makers and employees.

DAIRY INSTRUCTION AT OTHER AGRICULTURAL COLLEGES OF SECONDARY DEGREE.

At the secondary agricultural college at Groningen and at almost all agricultural winter schools, instruction is given in butter and cheese making, on the one hand, to give the pupils some notion of the principal parts of manufacturing butter and cheese, and, on the other hand, because at some future time, when employed as practical farmers, they ought to be impressed with the great importance of supplying well-produced and properly treated milk for manufacturing butter and cheese and for the use of milk as an article of food for man.

At the same time the importance of controlling the quantity and composition of the milk is discussed and, in connection with it, the importance of control associations and of breeding-control associations in order to increase the productivity of our dairy cattle, which enjoys already such a high reputation.

The details of practical butter and cheese making are not given much attention at these schools, because this part of the industry in the greater part of our country has been transferred completely from the farm to the creamery and cheese factory. More attention is paid to this part at the schools, situated in the sections in which cheese making is still, in smaller measure, carried on at the farm, viz, in North and South Holland and in the Province of Utrecht.

We attach a list of the subjects taught at the above-mentioned schools.

Composition and qualities of milk: Circumstances influencing the quantity and the quality; determination of specific gravity, fat percentage, and dry substance; milking and treatment of milk; bacteria found in milk; principal parts of manufactural butter making; skimming, Pasteurizing, ripening of cream; principal parts of cheese making; practical exercises in the examination of milk at the laboratory; making milk lists, milk registers, and calculations of produce.

At the secondary agricultural school at Groningen, which has a three years' course, about 60 hours are devoted in the second and third classes to butter and cheese making.

At most of the agricultural winter schools during the course of two half years in winter lessons are given during 50 to 70 hours and five practical lessons are devoted to the examination of milk.

At the schools at Schagen, Dordrecht, Utrecht, 100 hours are devoted during the whole course to butter and cheese making, and instruction in cheese making is extended, while at the same time more attention is paid to the examination of the quality of the milk for cheese making.

INSTRUCTION AT THE AGRICULTURAL WINTER COURSES.

What has been said concerning instruction at the agricultural winter schools is, in the main, applicable to this teaching; however, we should take into consideration that, with a view to the much shorter time at disposal, the teaching of the subjects is a great deal more simple and is restricted to the prinicpal parts. At these courses, too, the courses in the farming sections devote more hours to the cattle-breeding subjects, including dairying.

INSTRUCTION AT SPECIAL COURSES, ESPECIALLY FOR WOMEN AND GIRLS.

In different places of our country courses in butter and cheese making and the treatment of milk, especially for women and girls, is in demand. Such is the case in the cheese-making region of South Holland where the milk is used for cheese making, and the theoretical basis for cheese making itself is, of course, especially discussed.

If possible, practical demonstrative lessons during these courses are given, during which cheese is made under the directions of a dairy expert or an official belonging to his office, whereby all parts of cheese making are taught.

And, moreover, in some parts, where the farmer's wife is principally charged with milk production and treatment of the milk, the why and wherefore of the rules that can be given for it is discussed and elucidated.

COURSES FOR MILKERS.

In different parts of our country in which milk production forms an important part of agriculture, instruction is at present given in good and efficient milking. This is done principally by means of practical lessons, given by a practical person, who has mastered the art of milking thoroughly and who has been fitted for it specially at a training course established for this purpose and has been posted up in the knowledge of milk. Besides, a couple of theoreti-

cal lessons is devoted to the treatment of milk and the significance of correctly applied cleanliness and the causes of defects of milk.

The purpose of these courses is to make people see, as generally as it is possible, the great importance of good milking and of a good treatment of the milk and also to interest the laborers in it.

At the end of the course proofs of ability must be given in the presence of a committee of experts, after which a certificate can be obtained. These courses find more and more favor and interest.

SUR L'INSTRUCTION LAITIÈRE EN ITALIE.

GIUSEPPE FASCETTI, de l'Institut Expérimental de Laiterie de Lodi, Italie.

Par sa configuration spéciale la péninsule italique, exceptée la fertile plaine padane, présente la production et l'industrie du lait très divisées.

Dans toute la vallée du Pô, au contraire, qui est riche de prairies bien irriguées et de bétail laitier, la production du lait est abondante et sa transformation en produits laitiers très intense.

Cette transformation s'effectue dans de vastes établissements fournis de tous les instruments nécessaires, ou bien dans de modestes laiteries qui sont très nombreuses.

Pour ces considérations, en Italie la petite industrie domine sur la grande industrie laitière, laquelle a créé une multiforme qualité de fromages.

On justifie ainsi comment les instituts italiens de recherches expérimentales et les écoles de laiterie soient nécessairement induits de s'occuper tout spécialement de problèmes reflétants le perfectionnement de la technique des fromages et soient dirigés à enseigner aux nombreuses corporations des maîtres laitiers, qui comptent plus de 30,000 techniques.

Actuellement l'expérimentation et l'instruction de la laiterie en Italie sont développées par des instituts de divers degrés qui peuvent se distinguer en trois groupes:

I. Instituts et écoles à caractère supérieur.
II. Instituts et écoles à caractère moyen.
III. Instituts et écoles à caractère inférieur.

I. INSTITUTS ET ÉCOLES À CARACTÈRE SUPÉRIEUR.

C'est dans ces instituts et dans ces écoles que l'on développe l'expérimentation qui intéresse les problèmes majeurs du lait et de l'industrie nationale du lait et que l'on prépare les personnes qui se livrent à l'étude et les propagandistes de la laiterie, ainsi que les directeurs des grands établissements laitiers. Ces instituts sont:

1. L'Institut Expérimental de Laiterie de Lodi.
2. L'Institut Expérimental de Laiterie Méridionale de Naples.
3. Les Écoles Supérieures d'Agriculture, Milan, Pérouse, Pise.

1. *Institut Expérimental de Laiterie de Lodi.*—C'est l'institut le plus ancien et le plus complet d'Italie. Créé par le décret royal du 30 avril 1871, avec la dénomination de Reale Stazione di Caseificio,

fut transformé par le décret royal du 20 novembre 1919 à l'Institut autonome consortial de laiterie actuel.

Cet institut comprend deux laboratoires de chimie, un laboratoire de bactériologie, une laiterie expérimentale avec dépendance d'un élèvement de porcs et une ferme d'une étendu de 45 hectares pour la production du lait sur laquelle on fait des expériences.

Cette ferme est éloignée seulement de 2 kilomètres de l'institut. Le personnel scientifique est constitué d'un directeur technique pour la laiterie, d'un bactériologue et d'un chimiste.

La laiterie dispose d'un fromager maître technique et d'un sous-fromager.

Les buts principaux de l'institut, qui sont nommés dans le décret de sa fondation, sont:

(a) De faire des recherches scientifiques et technologiques sur le lait et sur ses dérivés, qui soit en rapport à l'alimentation humaine et à l'industrie, pour en déduire des connaissances sûres et précises;

(b) De poursuivre toutes ces expériences qui enseignent à obtenir le meilleur résultat technique ainsi que le majeur profit économique;

(c) De faciliter la divulgation de la science et de la technique moderne du lait, moyennant des cours périodiques d'enseignement, ainsi que par des conférences et des publications.

A ce but, il développe annuellement deux cours théoriques et pratiques de laiterie de la durée de 100 jours chacun, pour former des maîtres techniques et des directeurs de laiterie. Les matières d'enseignement comprennent:

Éléments de chimie générale, du lait et des produits laitiers.

Bactériologie générale et laitière.

Technologie laitière générale et descriptive.

Éléments de zootechnie.

Notions sur l'alimentation et sur l'hygiène des animaux domestiques.

Éléments sur la comptabilité des fromageries et des laiteries.

La partie applicative comprend les exercitations technologiques, les exercitations de chimie et l'alimentation des porcs.

L'activité de l'institut est recueillie dans les publications des Annales de l'Institut Expérimental de Laiterie de Lodi, qui apparaissent en brochures périodiques et tous les deux ans sont reliées en volume.

Les problèmes scientifiques et techniques qui intéressent majeurement cet institut se rapportent aux fromages du lait de vache que l'on produit dans l'Italie septentrionale ainsi qu'à diverses qualités de beurre.

2. Institut Expérimental de Laiterie Méridionale de Naples.—Cet institut a été créé par le décret royal du 11 juin 1921 et c'est pour cela qu'il est encore en voie d'organisation. Ses principaux buts devront être:

(a) Le développement et le perfectionnement technique de l'industrie laitière méridionale.

(b) L'étude scientifique et bactériologique de la fabrication des produits laitiers.

(c) L'enseignement théorique et pratique de laiterie pour former des maîtres habiles.

(d) Le contrôle commerciale et les analyses des matières premières et des produits de l'industrie laitière.

3. *Écoles Supérieures d'Agriculture.*—L'enseignement de la science du lait dans les écoles supérieures d'agriculture est généralement confié au professeur de technologie agricole. Mais dans quelques écoles (Milan, Pérouse, Pise) il y a un professeur spécialisé qui effectue un bref cours sur le lait et sur son industrie.

II. INSTITUTS ET ÉCOLES À CARACTÈRE MOYEN.

Sont compris dans ce groupe:

1. L'École Royale de Zootechnie et de Laiterie de Reggio Emilia.
2. L'École de laiterie annexe à l'École Royale Pratique d'Agriculture de Brescia.
3. L'Institut Pratique de Zootechnie et de Laiterie de Cuneo.
4. L'École Expérimentale Pratique de Laiterie de Bosa.
5. L'Institut Zootechnique Laitier de Rome.

Des instituts de ce groupe, seulement les deux premiers ont actuellement un fonctionnement régulier; les autres, créés il y a environ un an, sont en cours d'organisation.

1. *L'École Royale de Zootechnie et de Laiterie de Reggio Emilia.*—Cette école est douée de nombreux établissements distincts. Elle comprend la direction, le laboratoire de chimie, l'institut zootechnique, un pensionnat, la laiterie expérimentale et un dépôt de bétail reproducteur, avec deux grandes étables pour la race bovine et un porcher pour les porcs de reproduction.

Elle dispose aussi de deux fermes. Cette école a une fonction particulièrement didactiques, malgré qu'elle s'occupe de l'expérimentation zootechnique, laitière et agricole.

L'enseignement a une durée de trois ans et pour chaque cours le numéro des élèves est rarement supérieur à 20.

Les matières principales enseignées sont, outre les communes de culture générale, les éléments de physique, de chimie générale, agricole et appliquée à la laitière, la technologie laitière, la physiologie, la zootechnie, l'agriculture et la comptabilité agricole. Pour cette raison les jeunes gens diplômés par cette école possèdent des connaissances très diverses en matières agricoles, zootechniques et laitières.

Dans la branche laitière ils sont particulièrement habiles dans la fabrication du fromage "grana reggiano," qui est produit dans 2,500 fromageries de l'Emilia et, par conséquent, ils s'occupent du fonctionnement de ces fromageries et des petites fermes qui sont généralement leur propriété.

Parfois quelques jeunes gens se dédient à la propagande laitière auprès des Cattedre Ambulanti di Agricoltura qui fonctionnent dans les provinces les plus lactifères.

2. *École de Laiterie Annexe à l'École Royale Pratique d'Agriculture de Brescia.*—L'École de Laiterie annexe à l'École d'Agriculture de Brescia se trouve dans le voisinage de Orzivecchi et travaille le lait produit par une centaine de vaches existantes dans la propriété agricole de l'école. Elle a un fonctionnement essentiellement pratique confié à un chef technique de laiterie et complété par un enseignement théorique très sommaire. Chaque cours à une durée de six mois.

3. Institut Pratique de Zootechnie et de Laiterie de Cuneo.—Cet institut fut constitué le 23 juin 1921 avec les buts suivants:

(a) D'élever les types de bétail qui, ayant rapport à la race piémontaise, démontrent la meilleure aptitude du milieu agricole de la région et avec rapport spécial à la production du lait.

(b) Répondre avec l'expérimentation pratique les meilleures règles pour produire, conserver et utiliser les fourrages et les autres aliments.

(c) Par la conduite d'une fromagerie avec laquelle on enseigne la manière et le moyen de commencer à instruire pratiquement les producteurs de la région dans l'exercice rationnel de la fromagerie elle-même, surtout de celle à caractère familier.

(d) Contribuer au développement de la race porcine, ainsi qu'à la meilleure utilisation des résidus de la laiterie, soit moyennant un élèvement direct avec des reproducteurs de races choisies, soit en facilitant l'achat aux éleveurs de la province des reproducteurs provenant de l'institut, ou des autres élèvements de l'Italie où de l'étranger.

(e) Conduire directement et donner des subsides aux éleveurs de taureaux et concourir avec des prix pour développer entre les éleveurs de la province la production et la conservation des meilleurs reproducteurs.

4. École Pratique Expérimentale de Laiterie de Bosa, Sardaigne.—Cette école doit aspirer à mettre sur la voie rationnelle la production et la fabrication du fromage de la Sardaigne qui a pris un développement très ample dans la branche laitière, surtout dans la production du fromage "pecorino romano" (outre 100,000 quintaux) et des fromages à pâte filée.

Elle est actuellement à l'étude de sa constitution et de son organisation, car sa création a été seulement proposé l'année passée.

5. Institut Agricole Zootechnique Laitier de Rome, Monterotondo.—Cet institut a fait son apparition en juin 1922; il a une direction administrative autonome et possède une ferme de plus de 1,200 hectares de terrain à une distance de 20 kilomètres de Rome, sur laquelle on pourra faire produire au moins 30 hectolitres de lait par jour.

Ce lait coopérera à l'approvisionnement de la ville de Rome, en adoptant le traitement du lait le plus rationnel et le plus hygiénique, moyennant un établissement de laiterie moderne construite sur le terrain même, avec des machines à vapeur et frigorifères.

L'institut aspire en outre à devenir un lieu d'étude et d'observation pour les diplômes des écoles supérieures d'agriculture et de vétérinaire.

III. INSTITUTS ET ÉCOLES À CARACTÈRE INFÉRIEUR.

L'enseignement laitier à caractère inférieur, c'est-à-dire développé avec programmes réduits, moyennant de brefs cours de la durée de un à deux mois, aspire:

(a) A répandre les connaissances laitières modernes et les pratiques techniques qui sont proposées par les instituts supérieurs de laiterie et de fromagerie dans les différentes zones laitières du pays.

(b) D'élever la culture laitière chez les ouvriers des petites et des grandes laiteries.

A la première fonction ils pourvoient, moyennant des cours fixés, quelques laiteries annexes aux instituts ou aux écoles agricoles avec le lait qu'ils recueillent dans leurs étables, en s'occupant spécialement de favoriser le fonctionnement de la région.

Ces cours sont faits dans l'Institut Zootechnique de Palerme, Sicile; dans l'Ecole Royale d'Agriculture Pratique de Scerni, Chieti, dans l'Ecole Royale d'Agriculture Pratique de Caluso, Turin; dans l'Ecole Royale d'Agriculture Pratique de Sassari, Sardaigne.

A ces cours participent généralement les élèves inscrits à l'école même, dont l'enseignement d'une durée de trois ans est intégré par d'utiles instructions sur l'industrie laitière.

A l'instruction professionnelle des maîtres travailleurs de laiterie pourvoient les cours mobiles de laiterie qui donnent, ainsi qu'à l'instruction à domicile des intéressés.

Ces cours ont d'habitude la durée d'un mois avec un programme théorique et pratique uniforme au fonctionnement laitier du pays et ainsi spécialisé.

Ils sont organisés et développés par (a) les instituts ou écoles de laiterie qui se servent des techniques de laiterie à leur disposition, lesquels sont transférés où l'enseignement mobile est demandé; (b) les Cattedre Ambulanti di Agricultura qui parfois disposent d'un propagandiste laitier (Bergamo-Udine-Sondrio), certaines autres le demande aux écoles de laiterie; (c) des associations industrielles laitières.

On procède à l'organisation de ces cours de la manière suivante:

Dans la région où l'on veut faire un cours mobile de laiterie, on s'accorde avec une laiterie privée ou sociale qui présente une bonne installation; ensuite, on reçoit les inscriptions des jeunes fromagers qui sont occupés dans les fromageries du voisinage. Les élèves peuvent ainsi participer au cours sans abandonner leur demeure, où ils peuvent se rendre chaque soir.

Le nombre d'élèves admis a chaque cours varie de 8 à 10; il est souvent accordé un subside lorsqu'il démontrent de la diligence et du progrès, moyennant un examen pratique qu'ils doivent subir à la fin du cours.

Cette manière d'enseignement rapide et élémentaire a manifesté une grande efficacité dans les régions où il y a de nombreuses fromageries et, par conséquent, où il y a beaucoup des fromagers qui, dans l'exercice de leur fonction, n'ont pas la possibilité de fréquenter les écoles pratiques de laiterie à caractère fixe.

[Abstract.]

CHEESE-MAKING INSTRUCTION IN ITALY.

GIUSEPPE FASCETTI, Experimental Institute of Cheese Making, Lodi, Italy.

Experiments and instruction concerning the manufacture of cheese in Italy are carried on by graded institutions, which may be classified as follows: Institutes and schools of superior grade; institutes and schools of intermediate grade; and institutes and schools of elementary grade.

The higher schools and institutes are: The Experimental Institute of Cheese Making, Lodi; the Experimental Institute for Cheese

Making for Southern Italy, Naples (in process of organization); and the high schools of agriculture (Milan, Perugia. Pisa), where, in addition to chemical and agricultural technology, the science and technique of cheese making are taught.

Intermediate schools and institutes comprise: The Royal School of Zootechny and Cheese Making at Reggio Emilia; the Dairy School attached to the Royal Demonstration School of Agriculture at Brescia; the Demonstration Institute of Zootechny and Cheese Making at Cuneo; the Agricultural Institute of Zootechny and Dairying of Rome, at Monterotondo; and the Demonstration School of Cheese Making at Bosa, Sardinia (in process of organization).

The elementary institutes and schools impart elementary instruction in cheese making by rapid, intensive courses of one month's duration, at the Zootechnical Institute at Palermo, and at the royal demonstrational schools at Scerni, Caluso, and Sassari.

There are also short courses in cheese making given in some of the more advanced schools teaching that subject, as at Lodi, where every year two courses of 100 days each are conducted for practical and theoretical instruction in cheese making.

However, the principal task of the advanced schools for cheese making is that of experimental studies leading to the improvement of the cheese industry, since in Italy, where about 50 different types of cheese are produced, cheese manufacture is much more important than the production of butter or consumers' milk.

The Experimental Institute for Cheese Making at Lodi studies exclusively the manufacture of cheese from cow's milk. which predominates in northern Italy, while the Experimental Institute for Cheese Making for southern Italy, at Naples, studies the problems concerning goat's milk, or mixed milk.

In the intermediate schools instruction in cheese making is given principally for the purpose of training workers for small and large dairies and cheese factories. The courses last three years at the school at Reggio Emilia and six months at the school at Brescia.

In recent years dairy instruction, by means of intensive courses of one month's duration, has been greatly developed. This is done with the object of improving the technical ability of men working in dairies and in large or small cheese factories, as well as of small producers who can not attend regularly the established schools.

These traveling courses follow a didactic program suited to the particular locality in which they are conducted, in order that they may give the most practical results.

They are established, organized, and developed by—

Institutes and schools for cheese making.
Agricultural extension courses.
Organizations of cheese manufacturing firms.

These extension courses, where the cheese making industry is in greater need of assistance (as in the Provinces of Udine, Bergamo, Sondrio, etc.), are given by experts who lead a campaign in favor of the cheese industry, and by their activities and instruction bring the aid of science where its need is greatest.

SHORT-COURSE INSTRUCTION IN THE MANUFACTURE OF DAIRY PRODUCTS.

EDWARD HOLYOKE FARRINGTON, head of the dairy department, University of Wisconsin, Madison, Wis.

There is an old saying that the proof of the pudding is in the eating; and without attempting to mention all the possible fads and fancies that have been suggested as valuable subjects for short-course instruction at our educational institutions, I will confine my discussion to the type of short course that has stood the test of 30 years, and is "still going strong."

In educational matters there is a certain type of mind which takes for its financial standard either the kind of instruction that contains the most big words or the one that deals with matters that are little understood by them; in fact, their lack of a clear understanding of the subject often appeals to these minds as proof of the financial value of such instruction. As a rule, short courses of instruction are designed to appeal to the captains of industry rather than to the doctors of philosophy, and these courses therefore receive better financial backing from the former than from the latter. Conclusive evidence of the value the business man places on short courses of instruction is furnished by the records of the large classes that continue to attend the Wisconsin winter dairy short course. These show that business men request their employees to attend this short course and pay them full wages during the school period.

From the earliest times, or since the invention of the Babcock milk test and its application to the buying of dairy products at our dairy manufacturing plants, the short course of instruction in dairy manufacturing has proved to be attractive and well filled with students. These short courses vary in length from three days to three months at different institutions, and while it has been our experience at Wisconsin that the students taking our three months' course reply in answer to our questionnaire asking "How may this course be improved?" that "It ought to be longer," still we have not extended it.

We have not found it advisable to increase the length of this dairy course, principally because many of our cheese factories in the State close in November and begin operation in March. This gives a period of about three months when the operators of cheese factories may more appropriately attend a short course than at any other season of the year, or for any other length of time.

Our winter dairy course at the College of Agriculture, University of Wisconsin, Madison, Wis., is attended by young men who, as a rule, are spending money they have earned by working in some creamery or cheese factory, and they take the course because they expect it will help them improve the yield and the quality of the product they will make when they return to their jobs after the course.

A fairly good idea of the type of students who attend our Wisconsin winter dairy course may be obtained from the following list of inquiries we received during the year 1922 for men we have trained to fill positions in various manufacturing plants.

Applications received for Wisconsin short-course dairy students in one year.

Butter makers	150	Cheese makers	170
Ice-cream makers	58	College workers	12
City milk plants	8	Condensed milk	4
Manager dairy business	20	County agents	2
Creamery inspectors	3	Mojonnier testers	4
Cream receiving stations	6	Refrigerator operators	1
Testing dairy products	5	Field men	2
Pasteurizers	5	Dairy chemists	3
Churn man	1	Health officers	1

ENTRANCE REQUIREMENTS.

The minimum educational requirements of students for entering this short course are six months' training in some dairy manufacturing plant. No entrance examinations are given, but the student must present his written application signed by at least two of the following people: An owner or manager of a factory in which he has worked, a justice of the peace, a postmaster, or a priest or minister of the gospel.

AGE OF STUDENTS.

From the records of the students in attendance at the Wisconsin dairy course for the winter of 1922–23 we have obtained the following figures: Number of students between 18 to 20 years old, 24 per cent; 20 to 22, 19 per cent; 22 to 24, 22 per cent; 24 to 30, 22 per cent; and over 30 years of age, 13 per cent.

PREVIOUS FACTORY EXPERIENCE.

Creamery.—Students with 6 months' experience or less before entering the course, 8 per cent; 6 to 12 months, 14 per cent; 1 to 2 years, 17 per cent; over 2 years, 1 per cent.

Cheese factory.—Experience 6 months or less, 4 per cent; 6 to 12 months, 27 per cent; 1 to 2 years, 9 per cent; over 2 years, 1 per cent.

Ice cream.—Experience 6 months or less, 1 per cent; 1 or 2 years, 1 per cent; over 2 years, 3 per cent.

In answer to the question, "What did this course of instruction cost you, including railroad fare, board, room, and miscellaneous expenses?" we received replies from 60 per cent of the students, and from these we find that the expense of 28 per cent of the students was between $150 and $175; of 28 per cent, between $175 and $200; of 33 per cent, between $200 and $250; of 11 per cent, over $250. The largest expense account reported by any one student was $350, while the smallest was $131.

According to the last report of the dairy and food commission there were 2,807 cheese factories, 667 creameries, and 67 condenseries in Wisconsin. A State law requires all operators of these factories to have a license, which is issued by the dairy and food commission each year; and by comparing a recent list of the licenses issued to such operators with a list of the names of our former dairy students we find that at the present time there is in Wisconsin one student in about every third factory of the State, although during the past

30 years 3,956 students have attended this Wisconsin short course in dairy manufacturing, and 379 of these came from other States and foreign countries.

PLAN OF WISCONSIN DAIRY SHORT COURSE.

The short course of instruction in the manufacture of dairy products at Wisconsin is given according to the following plan. There are five divisions in which instruction is given: The creamery, the cheese factory, the ice-cream factory, the laboratory, and the shop. The entire class meets in the lecture room at 8 o'clock every morning, where some professor connected with the school gives a general lecture. At 9 o'clock the class is assigned to the five laboratories: Section I to the creamery, Section II to the cheese factory, Section III to the laboratory, Section IV to the shop, and Section V to ice-cream making. Each section works for three hours (9 to 12) in the factory to which it is assigned.

After the noon recess, a lecture is given to the entire class at 1.30 by another one of the professors and at 2.30 the students again return to the factory work of the different divisions, continuing from the place where they left off in the morning.

This routine of instruction is continued for one week, after which time the students change their laboratory work after the morning lecture. Those who have the previous week worked in the cheese room go to the laboratory, the creamery students to the shop, the laboratory men to the cheese room, and the shop men to the creamery. By changing their laboratory work once each week during the 12 weeks' course, they have an opportunity to take the creamery, cheese factory, laboratory, and shop work during 3 weeks, or for one-quarter of the 12 weeks' time they are in attendance.

The dairy department is supplied with milk and cream from over 200 farms. This is received by a group of students assigned to this work each day; the milk is skimmed in the creamery or made into cheese in the cheese room. All the work of operating the various machines, apparatus, and processes of manufacture is done by the students under the direction of some one of the 17 instructors connected with the dairy department.

The various divisions of the department are fully equipped with the appropriate machines, apparatus, and supplies used in our best modern dairy manufacturing plants. The instructors having charge of students in the various laboratories are selected from former students who have had several years' experience in factories after taking our course of instruction.

The fundamental purpose of the instruction is to teach students not only how to operate the various machines, and how to perform the manufacturing processes, but also to learn the reasons for each step taken in these manufacturing processes.

The products of the dairy department are sold locally, and the funds received from such sales are somewhat more than the amount paid the 200 farmers from whom the milk and cream supply is bought. The department, however, is not operated for the purpose of money making, but to give every student an opportunity to learn how to manufacture dairy products of good quality and to understand the operation of the same machines, apparatus, and methods that are used in factories throughout the country.

At appropriate times during the course, students are questioned for the purpose of finding out how well they are understanding the work they do, and these oral quizzes are followed by written examinations on the subjects.

In all this instruction an effort is made to help the student rather than to mystify and confuse him, and the extent to which the teaching staff has been able to do this is measured by the written quizzes which are given frequently during the course.

A brief outline of the subjects discussed by the lecturers and laboratory assistants and offered to the students in this course will include lectures on dairy manufacturing-plant management; creamery butter making; factory cheese making; ice-cream making; the laboratory inspection of milk and of other dairy products; the construction and repairing of machines and implements used in dairy manufacturing plants; dairy bacteriology; dairy chemistry; marketing dairy products; and allied subjects.

At the close of this three months' course of instruction a student is furnished a statement of the standing he has been given in each one of the courses of instruction he took. After leaving the school and obtaining a position in some dairy manufacturing plant he is a candidate for a dairy-course certificate, which may be obtained by reporting the work he is doing at some factory each month on blanks supplied by the dairy department. After seven such blanks are received by the dairy department, a representative is sent to the factory of the candidate, and if his inspection of the factory is satisfactory as to cleanliness, convenience of arrangement, and interest of the candidate in his work, this candidate is recommended to the appropriate authorities for receiving what is called a dairy certificate. A candidate while working for this certificate must fill some responsible position in the factory; in many cases he is the only operator, and has charge of the creamery or cheese factory.

At intervals during the year the dairy department mails notices to creameries and cheese factories throughout the State requesting that a package of the butter or the cheese be taken from the everyday make of the factory and forwarded to the dairy department for inspection as to its quality and composition. These packages are scored by a group of three to five judges, each one filling out his own score card, all of which are returned to the factory operator who sent the package for inspection; and together with the score cards, a letter of comment on the quality and the composition of the product is forwarded to the operator from a professor at the dairy department.

This, in brief, gives an outline of the short course in dairy manufacturing which has been given at the University of Wisconsin for the past 30 years, and which during that time has been attended by more students than there are creameries, cheese factories, and milk condenseries in the State. This, however, does not mean that every dairy manufacturing plant operator in the State of Wisconsin has taken a course of instruction at the university of the State, because 12 per cent of the total number of our students have been nonresidents, and in addition to this many of our students obtain work in other States. A certain percentage of our former students also fail to follow this occupation; some become farmers, others salesmen and inspectors, but most of them are connected in some way with the dairy industry.

While it is true that the majority of the students taking this short course of instruction have not had much school training, and only 14 per cent of them have had some college training, still the professors and the teachers of these classes are unanimous in expressing the pleasure they take in teaching students of this type. The fact that most of these students are depending on money which they have earned in some factory and, further, that they have already developed a liking for the work, helps a great deal in making this short course of instruction both pleasant and profitable to teacher and student.

SESSION 13. METHODS OF EDUCATING THE PUBLIC TO THE VALUE OF MILK.

Honorary chairman, Dr. A. F. BARRERA, chief, Infant Hygiene Service of the Republic of Cuba.

Chairman, Dr. LOUISE STANLEY, chief, Bureau of Home Economics, United States Department of Agriculture.

Secretary, Miss FLORENCE L. HALL, specialist in milk utilization, Dairy Division, United States Department of Agriculture.

FIRST BAPTIST CHURCH ASSEMBLY HALL,
Syracuse, N. Y., Monday, October 8, 1923—9.30 a. m.

Chairman STANLEY. The meeting will please come to order.

The first paper this morning will be by Dr. Haven Emerson on "Per capita milk consumption from the point of view of the public health officer." Doctor Emerson is director of the Institute of Public Health, College of Physicans and Surgeons, Columbia University. Doctor Emerson. [Applause.]

PER CAPITA MILK CONSUMPTION FROM THE POINT OF VIEW OF THE PUBLIC HEALTH OFFICER.

HAVEN EMERSON, A. M., M. D., professor of public health administration, College of Physicians and Surgeons, Columbia University, New York City.

"Food we can have in abundance if we devote our time to the conquest of the earth and to the utilization of nature, rather than to conquest of each other * * *. There is good reason to believe that the available resources of the world are increasing quite as rapidly as the population, and that they will continue to do so for a number of generations if man devotes himself to science and industry rather than to war."[1]

With such opinions expressed by eminent authority, it would be out of place for us to spend time just now in discussing the possibility of the production of milk sufficient to meet the reasonable needs of any or all people. We may assume that all the milk that is needed or that people can be taught to use for food, within the limits of economical and advantageous dietaries, can and will be produced through the natural response or adjustment of supply to demand. Nor shall I venture to enter the lists among the dietitians and the physiological chemists to dispute their conclusions as to the desirable use of milk for food. Rather shall I offer some considerations of the use of the public health office as a means of obtaining and distributing exact facts about the use of milk and the relation of this to the well-being of the community.

The health officer of to-day has traveled far and fast from his position in the public mind as a sort of glorified sanitary policeman, eagerly searching for smells and opportunities to prosecute the unwary for a defect of plumbing, or as the personification of a militant quarantine, enforcing the appearance of science to the great annoyance of blameless but suspected persons.

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[1] The World's Food Resources. J. Russell Smith.

He is no longer concerned with communicable diseases alone, among the multitude of preventable afflictions for which education and public protection or service are required. He is by charter, or by the force of public opinion, obliged to take notice of all disabilities or handicaps to health, as well as of deaths and diseases, for which a proved or probable cause has been declared upon scientific evidence.

He must nowadays create a public opinion, interested and determined to be informed, on all elements within our control which affect unfavorably the development, growth, and duration of human life, and, furthermore, he is forbidden to be content with the more negative success displayed by an absence of sickness, but is called upon for leadership and public direction and training, in raising the level of living until an aggressive desire and competent knowledge of the ways and means to acquire vigorous health are prevalent throughout his community.

Thus it becomes the function of the health officer to learn the habits and customs of his people, their racial and religious prejudices, much of the intimate economies and household practices of the families, for in a knowledge of these lies the answer to the question which shocks and disturbs us all. Why in a nation of unparalleled wealth, with the machinery of distribution of supplies unequaled, with the facilities for elementary education in the main accessible to all, should we see deformity, physical impoverishment, bodily and mental stunting widespread among our childhood and apparently not decreasing materially?

Two possible and often powerful influences which we might expect to correct much of the prevalent inadequacy or inappropriateness of diets at all ages and throughout the country seem to be on the whole inoperative. I refer to *thrift* as applied by an intelligent economy in the purchase of foods, and *devotion* to childhood as practically expressed by provision of food to meet the requirements of growth, repair, and energy. To be explicit, we know that milk costs less almost everywhere in this country than any food, or rather foodstuffs, capable of providing equivalent value for the nourishment of child or parent.

The two facts contained in this statement, the cost fact and the value fact, are the essence of the argument and offer ample justification for the health officer's assuming a direct interest not only in the sanitary or bacteriological control of milk, but in the extent and manner of its use and in its cost.

May I propose such questions as many a health officer is asking himself to-day, and to some extent answer them, as they may be, more or less satisfactorily.

(*a*) What is the desirable per capita consumption of milk in a typical American community?

By typical I mean a mature permanent or stable group of persons of all ages with no unusual distribution of the important age groups, no specialization in a particular industry which might affect the age, the income, the standards of living, or the dietary needs of the people.

Present information as to cost and value makes it quite clear that the entire community would save expense and serve their nutritional needs best if as much as 1 quart of whole milk were used as food for each member of the population daily. We can go further and say that it is indispensable for steady growth and development of children, at least until they reach school age, that a quart of milk should enter their daily dietary. We can add a third summary of the situation to the effect that unless at least a pint of milk a day per person is used in a community, waste of income and serious nutritional errors are certain to develop and affect the vitality, sturdiness, and capacity to resist disease, of a large number of both children and adults. Let me add further that none of these statements implies that these are measures of what each person in the community is supposed to drink daily in the form of whole fluid milk. I am not bringing this to your attention and saying that each person in the community must sit down to two or more large glasses of cold fluid milk, and if they don't take it in that form they have lost their right to live and keep healthy. The use of milk in all forms of foodstuffs, soups, sauces, puddings, ices, hot and cold drinks, etc., is included in the daily designated allowance.

This estimate of advantageous use of milk does not include the milk from which the finished products, butter and cheese, are made, nor does it include the skim-milk powders or the condensed and evaporated milk preparations.

The above statement of an optimum per capita use of milk of 1 quart per day for the entire population and a minimum safe allowance of 1 quart for each child under 6 years of age and not less than 1 pint for the remainder of the population is not based upon any single social, economic, chemical, or physiological test, study, or experiment, but represents the sum of observation in many relief agencies, budgetary studies of families under nursing and dietitian care, taken together with the experience of physicians and of medical services in hospitals, and the exact records of camps, institutions for children and adults, etc.

This general conclusion can be readily verified by anyone with a fancy for figures who will calculate the essential and accessory food qualities and contents of milk and its effect in causing and maintaining good nutrition, growth, and development when used as suggested.

The gist of the matter is briefly expressed, and in terms not likely to be subject of dispute, in a recent radio release issued September 22 by the commissioner of health of the State of New York, Dr. Matthias Nicoll, Jr.:

> A quart of milk a day for children, but be sure that it is clean and pure milk. Milk is a very important food not only for infants and children but for adults. It is an almost perfectly balanced food, containing practically all of the necessary elements for the growth, energy, and repair of the body in about the right proportions and in readily digestible form. The importance of milk as an article of diet for children is emphasized by the fact that it is the only food that provides sufficient lime for the proper development of the teeth without including an oversupply of other food elements. Children should have at least a quart of milk or its equivalent in milk products daily.

I know no good reason or valid argument against the opinions here expressed and shall proceed to the consideration of practical experience so far as the records can be relied upon.

(*b*) Is the consumption of milk a matter of accurate or complete record?

A positive answer can hardly be given to this question at present, but some facts of obvious value can be reported from reliable sources, and unpublished data can be made available.

The Department of Agriculture is authority for the statement that in 1900 the nonfarming, i. e., the urban and suburban population of the United States, purchased milk and cream exclusive of milk used in the making of butter, cheese, and condensed milk products, to the extent of 23 gallons per capita or 184 pints per capita, or one-half of a pint per capita per day throughout the year. The average per capita consumption of whole milk in the United States is given by the same authority as 0.93 pint per capita per day in 1917, 0.94 pint per day in 1920. The figure for the urban and suburban population of the United States given above, namely, one-half a pint per capita per day of milk consumed in 1900, apparently was duplicated by the experience of Philadelphia as late as 1900, while in London, England, in 1892, the amount used was officially given as 0.25 pint per capita per day. In New York City, for which I was able to obtain the most nearly accurate information for the past five years by months, the daily per capita consumption of milk has varied as follows, using for each year the highest mid-year (i. e., June, July, and August) receipts and the population of the city as of July 1, based on the figures of the Federal Bureau of the Census: 1917, 0.52 pint; 1918, 0.39 pint; 1919, 0.37 pint; 1920, 0.46 pint; 1921, 0.44 pint; 1922, 0.41 pint; 1923, 0.54 pint.

Among the tables published by the United States Department of Agriculture in June, 1922, in the Handbook of Dairy Statistics is one showing the variation among a number of countries from which we can calculate the daily per capita consumption in pints, showing Sweden (1914) at the head with 1.5 pints per capita per day, Denmark (1914), Switzerland (1914), Germany (1913) following closely, all using more than 1 pint per capita per day. Canada (1916), Hungary (1914), and the United Kingdom (1914) fall in the low group using just above (0.57 pint, Canada) or just below (0.49 pint, United Kingdom), 0.5 pint per capita per day.

Apparently in this country there is fairly consistent experience in the past five years in the use of milk, about 47 per cent of the total production going to household use and ice cream, and another 4.5 per cent to condensed milk. The waste or loss of all milk production runs about 3 per cent per annum.

Among the 83 cities of the United States of 75,000 population or over studied by the committee on municipal health department practice of the American Public Health Association in 1920,[2] 14 had no records sufficiently reliable to permit calculations as to per capita daily consumption of milk. These represented urban populations aggregating 2,055,985.

Of these 14 cities 6 were in the Pacific Coast States, 3 in New Jersey, 2 in Massachusetts, 1 each in Kansas, Ohio, and New York. Of the remaining 69 cities 6 reported a daily per capita consumption of 1 pint or more.

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[2] Published by the Government through the Public Health Service and is available for distribution as Bulletin 136, United States Public Health Service. It is probably the most accurate and comprehensive study of the functions and results of the municipal health departments in this country which has been made.

	Pints.		Pints.
Springfield, Mass	1.10	Detroit, Mich	1.30
Cambridge, Mass	1.15	Canton, Ohio	1.37
Pittsburgh, Pa	1.19	Paterson, N. J	1.48

Seventeen cities reported a daily per capita consumption of less than one-half pint.

First group, over 500,000.

	Pint.		Pint.
Baltimore	0.35	New York	0.46

Second group, 250,000 to 500,000.

	Pint.		Pint.
Indianapolis	0.47	New Orleans	0.34

Third group, between 75,000 and 250,000.

	Pint.		Pint.
Atlanta, Ga	0.27	Oklahoma City, Okla	0.21
Birmingham, Ala	.13	Omaha, Nebr	.40
Dallas, Tex	.45	Richmond, Va	.34
Elizabeth, N. J	.48	San Antonio, Tex	.44
Jacksonville, Fla	.39	Savannah, Ga	.47
Memphis, Tenn	.29	Worcester, Mass	.39
Norfolk, Va	.48		

It will be noted that of these, 13 are southern cities, New York, Indianapolis, Elizabeth, and Worcester being the other 4. The remaining 52 cities studied reported daily consumption from 0.5 to 0.99 pint per capita.

As might have been expected, study of the general death rates, the death rates from tuberculosis, and the infant mortality rates of these cities show no relationship with the reported per capita consumption of milk in these cities. And I would like to emphasize this fact because we are so prone to measure every health activity by its effect upon death rates, and particularly upon the infant mortality. What we are dealing with is the sickness or inefficiency due to consumption of milk; it is not death, but the incidence of a lower vitality and all that multitude of nutritional disorders which do not appear in the records of the health department or hospitals or physicians or dispensaries. In other words, we have no index of sickness or disability which we can compare with the consumption of milk, and we can not properly use death rates as a measure of the effect of the consumption of milk upon health.

It must be admitted that there is laxity and indifference among health officers of municipalities in this country in the accurate recording of the quantity of milk consumed in their community, whatever may be the character of their administrative control of the chemical and bacteriological quality of this food, concerning which the chapter of the forthcoming report dealing with milk inspection in these same cities (American Journal of Public Health, 1922) gives valuable information.

(*c*) Taking the most favorable situation, that of a city where the health officer knows the quantity and quality of the milk consumed, is it his function as a public official to attempt to influence the people in the use of milk?

As has been suggested above, the health officer in our cities is more and more expected to direct or encourage educational efforts of schools, civic associations, and private health agencies so that all members of the community as may be proper to their age and condition will consciously and intelligently take a personal interest in their own health and follow the teachings of physicians, not only in self-protection against the acute communicable diseases, but in the subject of nutrition and growth and development upon which well-being and self-support so largely depend. The health officer should lose no opportunity to teach the public, and particularly those groups in sections and districts where, by reason of ignorance, poverty, alien racial customs, and lack of adaptability to new and unfavorable industrial and environmental conditions, he finds among the school children, in the preschool clinics, at the baby health stations, in the prenatal clinics, in the records of tuberculosis, the evidences of unsuitable or inadequate use of foods which would be largely corrected by the increase of milk in the family dietaries. Not only among the poor and the handicapped but among the people of means do physicians find the evidences of poor dietary habits in the serious undernourishment of children.

No one, so well as the health officer, can create and develop confidence in the safety of the milk offered for sale, or take part as representative of the public in controversies and conferences where the producer and distributer require the steadying influence of the consumer's needs to prevent them from taking unwise advantage of their control of this public necessity.

It is probably of quite as much importance to the health officer to know the distribution of milk by districts, corresponding to the population units upon which he bases his analyses of deaths and sickness, as it is to know the birth rate by wards, assembly districts, or smaller permanent sanitary or block units. Only by having such exact information can he speak with point and accuracy in his teaching of the relation between family milk consumption and the health of the children. So far as I know, no city provides among its records of food control for current information as to use of milk by districts in the community. This could be arranged for with but little difficulty by cooperation with the milk distributers.

We are accustomed in this country to think of a city as a homogeneous, uniform mass of people all of the same intelligence and habits and needs. By a very simple method of using the Federal census figures, the city of New York has adopted a method of reporting its sickness, births, and deaths which has proved invaluable. Suppose we thought of New York City as a place where the death rate in tuberculosis was 93 per 100,000. That doesn't mean anything when we know that in the Riverside Drive section the rate is 50 and in the Bowling Green section it is 1,170 per 100,000, higher than in any other section of any city that we know of. Remember that you must analyze every community by reasonably consistent neighborhood and population groups. Therefore health officers have to divide their community arbitrarily into such districts as to be able to make a study by those districts. It is an entirely practical thing to do. If he finds that the Italians, perchance, are using a quart of milk per day because of some intensive education among them, and that on the other side of the main thoroughfare a Jewish group from southeastern Russia has not learned at all to use our whole milk in this country, it is up to him to swing his education where it is needed, and not to consider the community as all of one uniform condition in intelligence or information.

(*d*) Once exact information as to the daily per capita use of milk for the whole community or by subdivisions is obtained and these data are available by months or seasons and for several years, there will arise at once comparison among cities and queries as to the reasons for increase or decrease in use. While lack of information as to its value is perhaps the most obvious cause of failure to use to full advantage anything offered for sale, there may be other factors of importance. We have noted during the war period and subsequently an unwillingness on the part of the buying public to continue to pay higher prices equally for all articles, however reasonable the increase of price might be. While apparently willing to pay 100 per cent or greater increase in the price of shoes, clothing, and meats, for instance, the resentment against even a 50 per cent increase in the price of milk was so great as to cause marked reduction in use. No such statements as this can serve in place of thorough economic studies, but it is of some significance that during the years 1917 to 1923 the prevailing New York price for grade B milk net to the farmer rose from 5.68 cents per quart in 1917 to 7.58 cents per quart in 1919 and 1920, and dropped again to 6.42 cents per quart in 1921, the retail prices showing similar changes. The daily per capita consumption of milk followed a reverse curve during the same period, being 0.52 pint per capita in 1917, 0.37 (the lowest for many years past) in 1919, rising again to 0.44 pint per capita in 1921 and to 0.54 in 1923.

The public still needs much education as to the price of milk and the fact that milk purchased even at the present higher level of prices is a bargain in food value.

Some people living where there is little or no sanitary control or Pasteurization of milk have limited its use to cooked products in the household. Others who conceive a dislike of the taste of the Pasteurized product have similarly reduced their use of milk. In some of our large eastern seaboard cities, with enormous immigrant and first generation populations of foreign parentage, where the southeastern European peoples predominate, we have racial customs acting as a cause of lowered per capita consumption. These people rarely use raw whole milk in their own countries and are unwilling to use the Pasteurized product when they have been accustomed to soured or fermented milk.

(*e*) Conversely, as the price of milk has fallen, as the campaign among school children for normal height and weight gains has become widespread and popular, as confidence in the safety, uniformity, and value of milk has grown through the teaching of health officers, doctors, nurses, dietitians, and other social workers, the per capita use of milk has increased.

Certainly the slogan of the war period affected the habits of many a family, and housewives commonly observed the advice to buy a pint of milk for each member of the family before buying meat. I have been informed by personal communication that in one city of first rank in Canada, where a benevolent monopoly of the milk distribution has been developed in the hands of one man, and in a similarly important city in the United States, where a cooperative undertaking including milk production and distribution was brought about following difficulties between the city distributors and the wagon men, the price of milk has fallen and the consumption risen, but I could not obtain exact facts to quote here.

(*f*) Accepting, then, as facts that the daily per capita use of milk for food has in few if any cities of this country reached the optimum of consumption proposed above, and that the great majority of our larger cities do not record even the minimum advantageous daily use of milk as a food, and, furthermore, that our information is extremely crude and leaves many points of importance as to use open to doubt, what shall be the program or attitude of the health officer, whether of cities, counties, or States, in this matter?

The four essential services of probable value to the public, which a health office might properly engage in, fall under corresponding adminstrative divisions of any well-organized health department.

1. Through the statistical office all information as to the sale, distribution, and use of milk which can be obtained from any source should be assembled and correlated with the facts of record as to population, distribution, and the incidence of preventable defects, disease, and deaths.

2. Through the educational channels of the health department the public should be taught the simple essential facts, sanitary, economic, and nutritional, which will develop confidence and knowledge leading to a larger use of milk as a food.

3. Through inspection and laboratory control at an expense of probably not more than 5 cents per capita per annum, an adequate service for control of the quality of milk offered for sale can and should be maintained in the interest of health and public safety, as indicated in the report of the committee above referred to. A city without sanitary control of its milk supply is taking quite as great risks with its citizens as if there were no fire or police protection provided.

4. It is the particular function of the health officer to be informed and prepared to act in behalf of the consumer to see that all unnecessary costs and handicaps are removed from the production and distribution of milk so that the lowest price consistent with reasonable profit for the farmer and the trade is maintained with the minimum of seasonal variation.

I hope those who are interested and particularly concerned with the industry will not misunderstand that statement. The health officer has been responsible for a great deal of the obligatory increase in the price of milk, and his restrictions have been in the interest of public health and confidence in the milk industry. But there are conditions of distribution in cities brought about by laws meant to apply to other matters which seriously interfere with the economic distribution of milk, and it is the business of the health officer to concern himself with having these removed, by conference, discussion, and, if necessary, administrative action on the part of the city. This is just as important for him to do as it is for him to see that water of a standard purity is provided.

A definite policy and the prosecution of a vigorous program of education by the health officers of the country would go far to encourage milk consumption to such an extent that reduction in various nutritional disturbances of children and adults would ensue, and a great impetus would accrue to the dairying industry, the prosperity of which, more than that of coal and iron, is a measure of the intelligence, thrift, and progress of a nation in physical fitness and well-being.

It will be many years before the per capita daily consumption of milk in this country reaches an altogether desirable amount, but let us, for the present, aim to teach the people so well that enough is used to allow each child under 6 years 1 quart daily and all the rest of the population a pint daily per individual.

The wealth of the Nation in human and material resources will surely be greatly enhanced when the consumer demands and is prepared to pay for a safe quality of milk and an amount which will safeguard the nutrition of his family.

Chairman STANLEY. Are there any questions you would like to ask Doctor Emerson immediately? I think the general discussion had best be left until all the papers are read. But there may be some question that may be brought up now.

If not, we will proceed, then, to the presentation of the next paper.

Doctor Emerson has spoken of the importance of educational work. There is probably no one better fitted to discuss that subject in this country than Miss Lucy H. Gillett. We will have the next paper presented by Miss Gillett, who has charge of the nutrition bureau, Association for Improving the Condition of the Poor. Miss Gillett. [Applause.]

WELFARE AGENCIES AS A FACTOR IN EDUCATING CONSUMERS IN THE USE OF MILK.

Miss LUCY H. GILLETT, superintendent of nutrition bureau, Association for Improving the Condition of the Poor, New York City.

It is unfortunate that the public health officer has not always the funds at his disposal to develop as large a public health program as he likes. The welfare agencies are sometimes more fortunate in having private funds whereby they can help the public health officials to develop and put over a public health program. I think this is the attitude of most progressive welfare agencies, and this is what I have in mind in presenting this paper. We are only developing a program which can eventually be taken over by the public health agencies.

"Use a quart of milk a day." This sign greets the mothers and children who visit almost any welfare center, health station, or clinic room, until milk and health are looked upon as almost synonymous.

These stations and offices are usually in congested districts so that large numbers of people visit them. They are often among people from countries other than our own, people who do not speak our language or read our papers, who attend no public meetings, and who, therefore, do not get information through the ordinary channels of publicity, and are not swept on by the wave of enthusiasm from the outside world. Usually the people surrounding these centers must still be convinced that milk is cheap and indispensable in any health program at any price.

Yet these people form a large part of many cities and even rural districts, and their health influences our health. In raising the health standards of any community, therefore, this group must be educated. For our own sakes as well as theirs, and that of their children who will be our future citizens, they must be made to realize the importance of health, of attention to health habits, and especially to the drinking of milk. But how? They are hard to reach and slow to believe.

Such education must come more or less through direct, personal instruction. Welfare agencies, especially health centers, have a splendid opportunity of influencing these people because they come in very direct contact with them. The centers offer help in time of sickness or other trouble. Because they make the community feel that they are there to serve it, the people go for advice, whereupon a physical examination of each child in each family is encouraged, and many ailments are discovered. This gives the doctor a chance to advise the drinking of milk. Many boys and girls are undernourished because they have not been in the habit of drinking milk. These families are visited in their homes by social workers, nurses, nutrition workers, who, one and all, urge the use of milk not only for those already suffering from malnutrition, but for the whole family. Our aim is to build up a resistance to all disease, and naturally we consider milk one of our strongest allies.

Recommendations for the use of milk begin with the pregnant women. Each of them under normal conditions is encouraged to drink a quart a day. This advice extends on through the preschool, elementary, and high school ages of the children from every family.

Mothers and children are gathered together for demonstration in the proper care and feeding of children. Always milk, milk, milk, is emphasized—not as the sole food but as a necessary part of a complete diet.

The children make posters emphasizing good food and other health habits. These posters are placed in public places where they may be seen, and because the children have made them they attract attention and bring results. One poster which had a picture of a milk bottle with the caption, "Drink a quart a day," was placed in the milk station in the neighborhood. In two weeks the dealer said he had increased his sales from 150 quarts a day to 300. The people would read "A quart a day" and add "to keep the doctor away" and leave with an extra quart. Some of the posters are placed in the schools, others in clubrooms, and others in clinic rooms.

In one way or another, thousands of families are reached, thousands of children influenced, and a demand for milk is the result. Not only the children examined form the milk habit, but the neighbors also fall in line. They see the improvement in the health of the children drinking milk and reason: "If milk is good for my neighbors' children, if it will help to make them strong and keep them well, why not mine?" From every possible point milk is advocated until "A quart of milk a day" becomes the slogan in almost every district where a health center is located. A quart a day is our ideal and a pint the minimum.

But milk is seldom taught alone. If milk were the only food advocated the mothers would consider it an overbalanced idea which would soon vanish from their minds. It is taught as a part of a so-called well-regulated diet, and the diet is only a part of a complete health program. Rest, sleep, fresh air, and sunshine must all be given proper recognition before it can be shown what milk or any other food can do. The best advertising for any health measure is to present it in its right relation to other habits. This appeals to the majority of mothers as sane and sensible. The average human mind is open to reason. If milk is advocated as a part of a general scheme of a day's diet instead of the one and only food, the mother sees it in its proper relation and it and we are not considered fads and faddists.

We have had best results, most lasting results, where we have advocated milk together with vegetables, fruit, bread and cereals, eggs, and meat if desired.

A booklet recently published by the Association for Improving the Condition of the Poor contains suggestions for the proper feeding of babies, toddlers, school children, pregnant mothers, the preparation of luncheons, and other information that a mother should have. There are 24 pages. On each page milk is a very important, perhaps the most important, item; but it does not stand alone. For instance, on the page dealing with the food for the preschool child, the meals for the day are given with plenty of milk, a cup for breakfast with cereal, bread, and fruit; a cup for luncheon, with eggs and vegetables; and a cup for supper, with bread, cereal, or vegetables. These three cups, with the dishes made with milk, complete the quart a day.

We have probably sold more milk for the dealers through showing women how to use it in its proper relation to other foods than we would have through giving a quart per child outright for a year, with no recommendation about cereals, vegetables, and fruit.

Many mothers do not know how to use milk unless told, and even shown. Milk left at the door as a gift may be thrown away, left to spoil, or given away. Instruction should accompany it.

Some people may say, "But all this could be done through the schools." We, too, feel that it can be done equally well through schools in better-educated communities, and probably could be accomplished through the children in the foreign districts, but it would take much longer because of the slowness of these people in absorbing new ideas, and because of the indirect contact and the multiplicity of other responsibilites of schools.

It would take several years to accomplish through the schools alone what the welfare agencies are able to do in a few months. Human lives are at stake which make it seem necessary to act with speed and concentration. I believe both schools and welfare agencies working in close cooperation are necessary for best results.

A quart of milk per child per day may be questioned by some physicians. In addition to feeling responsible for the growth of the children under its care, the New York Association for Improving the Condition of the Poor also feels responsible to the financial supporters of the organization in making the best use of the funds at its disposal. We want to make the funds serve as many families as possible. Unless the children are materially benefited by a whole quart per day, we would not feel justified in advocating it. On the other hand, we do not want to take the responsibility of depriving children of the best chance for good health which food can give. Therefore the association conducted a series of experiments which it was hoped would throw some light on the quantity of milk best suited for optimum growth of children. These experiments were performed in cooperation with Prof. H. C. Sherman, of Columbia University. They were conducted under carefully controlled conditions and repeated several times at various seasons of the year, on different groups of children of different ages. The results seem quite conclusive that a child needs about a quart of milk a day to provide the calcium required for best developments. Furthermore, we were convinced that the body does not make equally good use of calcium from other foods. Therefore we do not hesitate to advocate a quart per child per day. On the strength of this experiment, made by one welfare agency, other agencies are recommending a quart of milk per child per day, and again we are helping to educate people through indirect contact.

At our fresh-air camps, where we entertain mothers and children for periods of two weeks throughout the summer, the milk consumed during these three months is in the neighborhood of 50,000 quarts, or about 600 quarts a day. These mothers and children form a habit which is bound to have its lasting effect. And it does have its effect, as is shown by the fact that the children often cry for milk after they return home.

Through practice, through direct teaching in the homes, and through literature, then, most health and welfare agencies spread the gospel of milk. Welfare agencies are recognized as having nothing to gain in advertising any one food. The people know that such organizations have only the best interest of the community at heart. If welfare agencies and milk dealers could cooperate more closely, their combined efforts would be of tremendous advantage to both.

The following slides show how one welfare agency is putting the idea of milk before the people:

Slide 1 represents our medical clinic where the children are examined for any physical defects. This is the beginning of our teaching the use of milk. This slide shows the doctor examining a child with the mother present. What the doctor says goes a long way. Through these clinics we have a large influence for educating the people. When the child and mother leave the clinic there is a nutrition person outside the door, who talks to them, emphasizing the good health habits the child should observe. Milk is always one of the things emphasized.

Slide 2 is a picture of a worker talking to a mother in one of the homes. The mother is being shown how to use milk. There are two or three mothers present from other tenements. The worker is showing them all how to make various milk dishes.

Slide 3 is a picture of one of the workers weighing the children to show the mothers how much they have gained. It shows a portable scale which the worker carries with her into the home. It interests the mother to see how much her children weigh. If their weights increase, and she has been following the health habits the worker teaches, it inspires her to continue. If the weight curve shows a downward trend, she is alarmed.

Slide 4 is a weight chart. One line represents the average weight of thousands of children of the same age. Another line shows what the child actually weighed throughout a given period. When the line begins to go up the mother is more than pleased and says, "If the child can gain that much with milk, he is going to have a quart a day." This weight line influences many mothers to continue the use of milk.

Slide 5 gives the general health habits given to all the children. Milk is advocated as one of the health habits in a general scheme of the day's program.

Slide 6 shows a chart made to illustrate the great value of milk. Black lines represent the growth-aiding material needed by the girl in the pictures. Beside it is a milk bottle with the black portion representing the growth-aiding material provided by it. At the extreme right of the slide you will see a column entirely blank which shows no such material in a cup of coffee. We are trying to discourage coffee and encourage milk.

Slide 7 represents milk as a part of a meal. That long column at the extreme right represents a whole meal—a milk soup with vegetables in it. In comparison, the second one represents the lesser value of a soup made with meat and vegetables, and this short line at the left is a clear soup with neither milk, meat, nor vegetables.

Slide 8: We are trying to impress upon the people that they need this calcium for bones and teeth. This chart gives them an idea of the foods which will best provide it. It also shows the amount of calcium in whole milk as compared with some of the other foods. Meat is one of the things they like best of all. This shows the comparison between milk and meat as sources of calcium.

Slide 9: These are foods which we encourage the people to eat between meals. Here you see the glass of milk represented, as always, in its proper relation to other foods.

Slide 10 shows one of our poster classes making the posters about which I spoke in my paper. One poster was put in a milk station and helped the dealer to increase his sales from 150 to 300 quarts a day. The girls are very much interested and calculate where they can put the posters so they will be of most use. We are trying to encourage a community spirit to help people develop the health habits throughout the district.

Slide 11 illustrates a poster which was made for us and is typical of posters made by the children. We try to make milk drinking a cheerful process. You see the milk bottle dancing with the boy and girl in a very joyful manner.

Slide 12 represents one of our fresh-air homes where a quart of milk is provided each day for each individual, both mother and child, and because of the habit started in these fresh-air homes, they are oftentimes persuaded to take the milk in their homes.

Slide 13 gives the type of diet suggested for the pregnant woman. Again we have a quart of milk. I think the best educational work is done where milk is represented as part of the ordinary diet.

Slide 14 shows the increase in the use of milk through education. These figures are taken from a restricted area. Out of about 292 who were getting a cup or less of milk a day, drinking coffee for breakfast, dinner, and supper, in three months' time we were able to decrease the number of children from 292 to 39 who were getting insufficient milk. This figure represents a summary of a small number, but the same holds true for all our work.

Chairman Stanley. Are there any questions you'd like to ask Miss Gillett?

Mr. C. L. Smith (agriculturist, Oregon-Washington Railroad & Navigation Co., Union Pacific System, Portland, Oreg.). I would like to say just a word. I have had considerable experience along that line in the schools of the country, and I find that a great many children have a distaste for milk. They don't want to drink milk. But they can be taught the use of milk by combining it with other foods, and what struck me as most fortunate in what this lady had to say is the combination of milk with other foods, like milk soups. I have known children who would refuse to drink clear milk and yet they were glad to get a soup. In the same way, you can combine milk in cooking with the various vegetables, milk gravy and things of that kind. They can be educated to the use of milk by combining it with the other foods, where it would take a long time to educate them to use milk without combining it with something else.

The mistake I have found in these campaigns is that they talk about milk alone, without milk in combination, and then those who don't care for it find ready objection. I suggest, in putting on a milk campaign, they emphasize the fact that milk is a most important factor in a diet composed of various things, because in my work—more with domestic animals than children—I emphasize it forcibly wherever I can. Where these other foods are mixed with milk people can be taught to use it much more quickly than they can in a campaign for milk alone.

Chairman Stanley. "The work of the Canadian Department of Agriculture in increasing the consumption of milk," will be presented by Miss Helen G. Campbell, demonstrator and lecturer of the dairy and cold storage branch, Department of Agriculture, Canada. [Applause.]

THE WORK OF THE CANADIAN DEPARTMENT OF AGRICULTURE IN INCREASING THE CONSUMPTION OF MILK.

Miss Helen G. Campbell, dairy and cold storage branch, Canadian Department of Agriculture, Ottawa, Canada.

It is a privilege for a visitor from another country to see and hear so much of the excellent work which is being done in the United States to increase the consumption of dairy products. The National

Dairy Council and Dairy Division are, I am sure, very proud of the tributes which have been voiced by the great child welfare associations of this country, for we deeply appreciate in Canada the confidence of similar organizations and their testimony to the value of work along this line being carried on by the Department of Agriculture. The paper which I am about to read gives in a rather general way the reasons for including these activities in the dairy and cold storage branch, an outline of the work as it is conducted, and the respects in which it has contributed to public health.

An industry which, by the character and quality of its products, contributes to the health of the population is an important one. Dairying on this account is one of the chief industries. It has a great commercial importance, representing large investments, and it is of great economic importance, as it is an industry which more than any other makes use of roughage which otherwise would be wasted, and converts it into valuable products. Its greatest importance, however, is in the food which it makes available for human consumption.

The standard in judging the importance of any business should be the extent of the service which it renders; and by providing foods of the highest nutritive quality, the dairy industry is performing splendid service and contributing to public health and national development. The use of dairy products is conducive to better health, and every educational activity which stimulates an interest in their nutritional value will result in two things: Advancement of child welfare and public health, and most effective advertising. To help a child gain or maintain health is the most practical way of furthering public health, and the healthy child is the best advertisement of the dairy industry.

The purpose of advertising is to tell the public about some article and arouse their interest sufficiently to induce them to make use of it. The force and power of advertising is well known, although we do not realize how much we learn from it and how greatly our opinions are formed and influenced by it. It is a tremendous force; and when employed to promote the use of some good and useful product, it is of vast service and educational value.

The town crier of olden times was really the official advertiser, but since then there has been great development along this line, until now business men realize that much of their success depends on telling the public of the goods they handle. More and more they realize, too, that advertising is not of much value unless based on honesty and integrity, but, backed by the guaranty "money back if not as represented," it has built great businesses and reputations for fair dealing all over the world. One of the first principles of success is to call attention, not so much to the article for sale as to the service which it gives, and better health for the child and the family is the service which the dairy industry has to offer. The clearer the realization of this fact on the part of the public and of those engaged in the industry, the more direct will be its value to the child and to public and national life.

No industry can perform a more valuable service than that of contributing to the solution of public health problems. Public health is not only the most important question in any country, but it is also the biggest business proposition. Disease and sickness cost annually a very large sum of money, as well as a great deal of suffering, and many other attendant evils, a large percentage of which could be saved if the public had a better understanding of the prevention of disease. An index to the importance of the question lies in the fact that the League of Nations has a more thorough and well-defined program in public health than it has in any of its other sections. It is receiving the attention of doctors, nurses, club members, and individual workers, and it demands the interest and support of each individual. Every woman in the home is a public health worker if she realizes her responsibility in guarding the health of her family, and if she trains her children in good health habits. The question of child welfare is important enough to receive the attention of all governments. There are departments of health with child welfare divisions in each of the Provinces of Canada, as well as in the Dominion Government, and other departments of the Government are contributing toward the welfare of the child, as are also many organizations, voluntary and otherwise, in various urban centers and rural communities.

The educational work being carried on by the dairy branch of the Dominion Department of Agriculture was undertaken in response to a need for greater information regarding the food value of dairy products and the bearing which these foods have upon the public health.

Great advance has been made in the science of nutrition during the past 10 years, and experiments and investigations have greatly enhanced the reputation of dairy products. Much of the undernourishment prevalent among school children is due to a faulty diet, the chief defect of which is an insufficient amount of milk and green vegetables, and the dissemination of information regarding these facts seemed to the dairy commissioner important enough to warrant the creation of a division which has this for its object. The newer findings of nutrition experimentation would be almost valueless unless they were properly brought to the attention of the public, and advertising of the right sort has a very real place in bringing scientific facts to the attention of the woman who prepares the meals for her family. It is important to teach good food habits to children, but the best results can not be obtained unless parents are taught, at the same time, the value and importance of their children forming good food habits.

The educational activity of this branch serves a useful purpose by emphasizing to parents the fact that in giving their children moral and physical training—in teaching them to be honest, truthful, and upright, and in teaching them proper health habits—they will find it equally true in each case that "What ye sow, that shall ye also reap." The mother and housekeeper decides what her family shall have for dinner; and because this is so, she is one of the important determining factors in the nation's health. If she thoroughly understands the relationship between proper food and good health, she is very much more likely to make a wise selection of food than she is if she has no understanding of the part which food plays in the physical well-being of her family, and if she is unaware to what extent "morality rests upon a sanitary and nutritive basis."

The woman in the home with no active interest in scientific research may not know anything about amino acids and complete proteins, but if she does know that the proteins in milk are of particular importance to the physical development of her child, and that in combination with other foods they make them more useful to the body, she is likely to see that her children get an additional supply. If she knows that milk is not only a valuable food for producing energy, but also that it contains essentials for growth and development and that it is an economical food, she is much more apt to give it prominence in the menus she prepares. If she can be shown that milk is one of the most important foods for the development of teeth and is made to realize the importance of an adequate supply, not only in the diet of young children, but in her own diet, she is willing to go to some pains to see that enough is used. People want to be healthy, and usually the only thing necessary is to convince them of the most effective means to that end—which proves the value of the right kind of advertising. The prevalent belief that drugs and patent medicines have such importance for physical well-being should be counteracted by education as to the proper place and real value of the various foods at our command. It is the object of the Dominion dairy branch, by the work of this division, to call attention and arouse interest in the value of milk and milk products and incidentally of other suitable foods—green vegetables, cereals, etc.

It is realized that the success and value of this work will depend on how useful it is to other organizations which have the welfare of the child at heart, and work has been done in close cooperation with child welfare, public health, and educational bodies—Dominion, provincial, and municipal departments of health, provincial departments of agriculture, schools of home economics, national and local child welfare associations, etc. The publications which have been issued by this division have been prepared primarily for the mother and home maker, to clearly point out the different reasons why milk and milk products should be the nucleus around which the diet is built. Distribution of these has been made chiefly by such organizations as have been mentioned. They are sent upon request to teachers, to public health workers, visiting nurses, officers of men's and women's clubs, etc., to place in homes where they will be of service. The Roman Catholic clergy are staunch and powerful allies in educating the public along these lines, and have distributed many thousands with the added word of commendation which gives to the message greater interest and greater weight.

Exhibits have been arranged for those to whom the strongest appeal is a visualization of the subject. They have been prepared at the request of home and school clubs, school trustees' associations, child welfare associations, etc., as well as erected at the various fairs and exhibitions. The requests for information and assistance following each exhibit show they have been of great value in directing attention to the subject and in arousing a greater interest in the consumption of dairy products. These displays have been reproduced on a smaller scale by public health nurses, and other local educational effort along this line in urban and rural communities has been stimulated and assisted by material prepared by this division. There is, in Canada, a very strong and active organization of rural women, the Women's Institute, which has contributed much toward the improvement of conditions in the country. This organization has done much to improve the quality of the milk supply and to increase the use of dairy products in rural communities where the consumption of milk is relatively small. Undernourishment is a problem not only of the cities but of the country districts as well, and the energy of institute members in combating this evil has resulted in much benefit to the rural child.

School officials are realizing more clearly than ever before the relationship between health and mental ability. "A sound mind in a sound body" is the ideal of broad-minded educators, and school inspectors and teachers frequently request the cooperation of this division in presenting to the children the message of the value of milk, thus helping to lay the physical foundation without which educational advantages count for little. Teachers welcome the cooperation of this division and are interested in any method of presentation which makes this phase of health education more appealing to the children. One teacher tells of a little chap in her class who listened to a story in which the building of his body was compared to the building of a house—the carrying out of every health rule adding a shingle to the roof and the breaking of any rule taking off a shingle. A few days after this, he noticed a boy who had just joined his class, buying coca-cola and candy at recess, and rushed to his teacher in great excitement to say, "Teacher, that new kid's rippin' the shingles off his roof." [Applause.]

Poster and essay competitions arranged by the dairy branch and conducted as part of the regular school program have resulted in great interest and surprisingly good work. These posters are loaned to teachers and extension workers who find them most useful in giving an impetus to similar endeavor in other communities. A doctor, requesting them for display at the sanatarium of which he has charge, remarked: "Milk is such an important item in the diet of the sick and convalescent that we want to interest the older boys and girls in the subject."

The distribution of milk in many schools has led to very satisfactory results in the correction of health habits and the improvement of the physical condition of many children. The mere distribution of milk does not meet all the demands of the undernourished child, but it has an important place in the school program, and it is not too much to hope that it will, in many places, be the basis of a thorough health education program, the need for which is apparent when we consider the extent of undernourishment among school children. The success of the school health program, whether conducted by the grade teacher, the household science teacher, the nutrition worker, or the school nurse, depends very much in securing not only the interest and cooperation of the child, but the cooperation of the home. Concurrent with activities in the schools, cooperation is given to local women's organizations and other bodies interested in health education, and there is conducted a program of education to reach the adults in the community as well as the children. By these activities and by means of motion pictures, slides, demonstrations, etc., salient facts of the value of these foods and the necessity for a satisfactory diet have been brought to the attention of the consuming public, chiefly to the woman in the home who chooses the day's meals. Where such work has been undertaken, developments have shown that it has been, in many ways, productive of excellent and lasting results.

Assistance is given in conducting milk campaigns or programs at the request or upon the invitation of some local body. I shall not take time to outline the general plan which is followed, or to give details of the work or results, except to say that in one of the smaller places, where the work was more or less centralized, there was an average daily attendance of 350 adults. The aim of this undertaking is to bring to the attention of children and adults, school and civic authorities, and voluntary workers interested in advancement the value of a satisfactory diet and the advantages from an economical, nutritional, and national standpoint, of a clearer realization of the paramount place of milk in nutrition. Results of such campaigns have been encouraging, the most gratifying being that communities are undertaking follow-up work to sustain the interest which has been aroused in more and better milk.

There is need for a clearer realization of the importance of milk in nutrition, its economic importance, and the necessity for careful handling before and after delivery. The careful handling of milk can not be too strongly emphasized to the woman in the home, as well as to the man on the farm. By arousing interest in the importance of milk as a food there is instilled also a sense of responsibility as to the quality of milk which she demands and the care which she gives it upon receiving it.

The Dominion dairy branch, by its educational work to stimulate a greater consumption of dairy products, adds its quota to the work being done to assure the fine character and strong, sturdy physique of the Canadian child.

Chairman Stanley. Are there any questions you would like to ask Miss Campbell?

Mr. C. W. Schmolke (Somerset West, South Africa). Madam chairman, I would like to ask what is being done to have milk introduced in the schools. Is it given out to the children?

Miss Campbell. It is given out in many schools in several of our cities. This distribution has been undertaken in many of our cities and is increasing rapidly.

Chairman Stanley. We are interested in the work inaugurated under the National Dairy Council and continued under the Child Health Demonstration, where a certain sum of money is set aside. We are going to have one of those demonstrators to describe his work. Dr. Walter H. Brown, who is director of Child Health Demonstration, Mansfield, Ohio, will speak to us about the health demonstration.

THE HEALTH DEMONSTRATION AND NUTRITION.

Walter H. Brown, M. D., director, Child Health Demonstration, Mansfield, Ohio.

I am very much pleased with what has gone before, because it does not always happen that the ground is prepared for what you are going to say to your audience. I am interested as a public health worker in seeing that the accumulated experience of our scientific group is translated into actualities in the individual community. I am also interested to capitalize our campaigns for particular objects such as increased consumption of milk. In order to do this we must influence children and lay, as the real foundation for the fixing as habits in the lives of our future citizens, the proven results of the scientific investigations. I will briefly describe the demonstration which I have the honor of directing. One of our main objectives is to thoroughly fix certain health habits in the lives of the children in order that they may function permanently—to be specific, that the results of a milk campaign will stay.

Health demonstrations have become fashionable as a method of promoting various phases of health work. The Child Health Demonstration at Mansfield, Ohio, represents a distinct type. It is an effort to show what a typical rural county, containing a small industrial city (population 31,000), can and should do to assure all of its children an equal opportunity for a full measure of health.

The problem is being approached by means of an alliance between the people of Richland County and the American Child Health Association. The funds for this five-year venture in cooperation are being furnished by the American Red Cross.

The goal of the demonstration is to develop a child health program which will be economically practical for the community, rather than to conduct an intensive laboratory experiment. This does not preclude the possibility of scientific study or interfere with the trying out of new discoveries in the health field.

The policy of the demonstration is one of assisting to build up all of the local agencies, public and private, which are concerned with the health of children. Guided by this policy, we have devoted our time and funds to the cooperative establishment of certain services which are conceded to be essential for the prevention of disease and the promotion of the health of children.

One of the valuable instruments in establishing and guiding these services has been a series of national advisory committees which were organized by the child health council. These committees are made up of recognized leaders in their particular fields. Through the generous assistance of these leaders we have been able to profit by the experience of health workers in all parts of the United States.

After a careful survey of health resources and health conditions of the county certain services were established. The final disposition of these services will be dependent upon sound community relationships. We feel that we have established such relationships with the official and unofficial health and educational agencies. The foundations have been laid for them to take over the parts of the work which have passed the experimental stage. This has already begun to happen.

A brief description of each one of these services will form a background for making clear our relationship for nutrition as a whole, and the use of milk in particular.

MEDICAL SERVICE.

This service is in charge of a full-time pediatrist. This physician has charge of all of the demonstration's supervision of well babies.

In addition he furnishes consultation services for any physician in the county without fee.

The well-children supervision has been conducted through a series of health centers. The main center is located at Mansfield, with three branch centers in various parts of the county.

This service is assisting in establishing a system of medical supervision of schools through cooperation of county dental and medical professions. This year through this service 3,000 school children have been given a complete physical examination with careful nursing, follow-up work for the correction of defects and promotion of health.

NURSING SERVICE.

The nursing service is a cooperative undertaking between Mansfield Public Health Nursing Association, Richland County Chapter of American Red Cross, Shelby Public Health League, and the demonstration. By the coordination of these organizations with the demonstration there is being built up a well-rounded program of nursing for the entire county. The work is being conducted on the generalized plan. City and county have been divided into districts, with one nurse responsible for all forms of nursing in her district. At present we offer prenatal, obstetrical, infant and preschool care, and school nursing.

One of the major activities is health education in the schools. The director of health education of the demonstration has been officially made supervisor of health education both in the city and county schools. We are working out ways to make health habits attractive to children. We are bringing to the teachers of Richland County the benefit of the experiences of the best health workers in the field. At the same time we are stimulating them to develop new methods of teaching health.

The nutrition activities of the demonstration are of special interest to this group of workers. Our nutrition service is in charge of a full-time trained nutrition worker. This gives ample opportunity for us to procure expert nutrition guidance for all divisions of our work.

I will not take the time to repeat the things which Miss Gillett placed before you. We are also covering them at Mansfield. They are taken up in the school instead of at the health centers. In the schools the work is correlated to the art department by means of the poster work. We have on exhibit in our health centers and county fairs and other places very admirable examples of the health projects which are being worked out by the children. We are bringing together all aspects of nutrition and placing it before the child all the way through his grades, to and including high school. We hope in this way to make this knowledge a part of the very life of the men and women who in the future will be responsibe for our dietary soundness.

It is the desire of the speaker to indicate the ways in which he believes the work at Mansfield is increasing the use of milk on a plane that will cause it to permanently occupy its rightful place among foods. In considering the topic from this point of view, it is necessary to remember that the demonstration is endeavoring to actually correlate all of its services in the solution of particular health problems. For instance, while nutrition projects are the major responsibility of our nutrition service the other services reinforce and assist in its operation.

A brief description of some of the nutrition activities will serve to illustrate both the methods of operation and the way in which we are educating the public to the value of milk.

UNDERWEIGHT CHILDREN.

The problem of the underweight child is one of the starting points of our nutrition service. All children in the county are being weighed and measured by the teachers. This activity is being used both as a service and a teaching device. The health education and nursing service are assisting in methods and following up the children. We are serving milk to all children 10 per cent or more underweight in the cities of Mansfield and Shelby and our six villages.

The 110 one-room schools are a different problem. By means of cooperation with the farm bureau and the extension service of the Ohio State University we are promoting proper school lunches. In this promotion we are making the rural child realize the wonderful value of milk, often no light task because familiarity has bred contempt with the rural child.

Through a carefully conducted propaganda and a series of demonstrations, it has been possible this year to secure the appointment of trained home economics teachers in the two cities and six villages of the county. By means of our intimate relationship with the establishment of these departments, we are enabled to guide these courses in a way that will permit nutrition being taught from the public-school angle. The director of nutrition service of the demonstration has supervision of all of these courses; in a particular way we are including in the teaching of these young women a proper relative valuation of milk as a food. It is our belief that this will have one of the most permanent values in the future use of milk as a large factor in the food of the family.

HEALTH EDUCATION.

In close correlation with the health education divisions, great stress has been laid upon the classroom teaching of health habits. In this teaching milk has been constantly stressed to the children by all sorts of teaching devices. A result of this is the direct testimony of the milk dealers of the increase in the demand for milk.

MOTHERS' GROUPS.

On account of our all-around program for the health of children, there is beginning to be built up instruction groups for mothers. In these groups the nutrition service has had another opportunity to point out the value of milk and to encourage its use in various ways by means of special devices for the use of milk in the food of children.

I would like to reiterate what Miss Gillett has pointed out to you, namely, that it is useless for us to go out and merely advocate a child drinking a quart of milk. If you have had experience with mothers in homes you will know that there is a mighty small percentage of them to-day who know anything about using milk except in its fluid form. So we are devoting a great deal of time, both in school and in the home economics courses, and by means of literature and other instructions, to show how milk may be used in all sorts of ways.

PUBLICITY.

We are using all of the usual methods of publicity such as newspapers, posters, literature, slides, and lectures. In addition, at the county fair our exhibit illustrated in a graphic way the relative and actual value of milk, while in the health pageants, which are an annual event, episodes are always included on milk.

We have been calling this type of effort education; some of our educators say it is not education. Not being a pedagogue, I will not attempt to discuss the question. I do feel, however, that we must arouse attention and solicit interest in the subject. If we thus set up plans that include follow-up work we are surely getting educational value, whether the method is classified as education or propaganda.

If time permitted, I should like to discuss our use of pageantry. This year there were two health pageants produced in competition by the villages from the northern and southern parts of the county. One hundred and seventy-five dollars was given in prizes by the county fair board. Over 400 children participated. We believe that the effect was certainly helpful.

THE MILK SUPPLY.

One of the things in which we are particularly interested is the character of the milk supply. It is futile for the public health worker to educate the public to the value of milk unless a pure, safe supply of milk is obtainable at a reasonable cost. In this it seems that the time has come for the closest kind of cooperation between the health worker and the commercial distributor of milk. It is not always that the economical objectives and the health objectives travel over the same track. In the case of the production and sale of milk this is true, for I am quite sure anyone who is familiar with the production, distribution, and handling of milk knows that healthy cattle and clean milk are both commercial and social objectives. Therefore, we are working intimately to secure an adequate official control of the milk supply. This as you know is not always an easy task in the smaller communities of our country where there are no well-organized health departments. In addition, we are cooperating actively with the farm bureau in its attempt to eradicate bovine tuberculosis.

In conclusion, the point which I wish particularly to bring to the attention of this meeting is that while all of the specialized campaigns for increasing the consumption of milk are useful and desirable, unless we follow them up with consistent and constant processes of education they will not permanently increase the use of milk. Therefore, we deem it fundamental that in the education of the child there shall be a continuous process of education in the relative and actual value of milk as a food. We are convinced that if there is a proper correlation between our publicity campaigns and our educational efforts, milk will very soon assume and hold its proper place as our most valuable single food.

Chairman Stanley. Are there any questions you would like to ask Doctor Brown before proceeding to the next paper?

Member. I would like to ask if cooked milk has the same value in a diet as the raw milk?

Chairman Stanley. I wish you would bring that up again before we close this session.

I think, when we speak of the agricultural work done by the Department of Agriculture we immediately think of the splendid work done by Miss J. M. Hoover since being associated with us. We are going to have her tell us about "Community milk-for-health programs as conducted by the United States Department of Agriculture."

COMMUNITY MILK-FOR-HEALTH CAMPAIGNS AS CONDUCTED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Miss Jessie M. Hoover, specialist in milk utilization, Dairy Division, United States Department of Agriculture.

Milk-for-health campaigns as conducted by the Dairy Division, Bureau of Animal Industry, United States Department of Agriculture, are organized educational programs planned to convey to communities adopting them, information regarding the value of milk as a food which is exceptionally well suited for growth, maintenance, and repair of the human body, as well as a valuable health food. This work is conducted cooperatively by the United States Department of Agriculture and the extension service of the State agricultural colleges through nutrition and dairy specialists and county agricultural and home demonstration agents.[1] It covers both urban and rural communities, and is usually conducted on a county-wide basis. County-wide campaigns are repeated until they practically become State-wide campaigns. A campaign is never undertaken unless it is desired by the community leaders after an investigation of the needs of their community has been made and it appears that there is a spirit of willingness to cooperate in improving these conditions. The campaign is divided into three parts: (1) Preliminary organization; (2) training school and practice (the intensive part of campaign) for extension workers and local leaders; (3) the follow-up, which covers a period of months or years. The local home demonstration agent or an especially appointed milk specialist is responsible for the successful conduct of the follow-up.

The ultimate object of the work is to assist in reducing malnutrition through an increased use of milk. The milk-for-health program, like many other projects related to foods, was an outgrowth of the World War. The nutritional needs of many nations received the most careful consideration during and since this period of conflict, and food as a means of sustaining life, promoting growth and health, and preserving vigor, was thoroughly studied. It was not until the World War that a comprehensive physical examination was ever given to any considerable portion of our population. But when the young men were examined for military service, it was found that 1 out of every 3 was unfit for active service at the front because of physical defects. A nation-wide program to ascertain the amount of malnutrition among school children was undertaken, and it was found that about 1 out of every 5 school children in the United States was 10 per cent or more under weight, according to the height-weight tables prepared by Dr. Thomas D. Wood, of Columbia University. It was also observed that poverty had little to do with this condition. The more important factors appeared to be ignorance or carelessness on the part of parents in the selection of foods for child feeding, and lack of discipline in directing the food habits of children. Obviously, the best remedy for this condition is education. Therefore, our first work was systematic educational programs for the parents. This was undertaken in the fall of 1918, but it met with only partial success, for mothers said, "We want our children to use milk, but they do not like it," and we found them constantly suggesting this idea of disliking to their children, by both precept and example. Profiting by this experience in our later work, which is described in this paper, we reach the children directly.

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[1] A woman agent of the Government employed to teach people living on farms or in rural communities better practices in agriculture and home economics.

Other conditions which brought about the need for educational milk work were of an economic nature. During the war an unprecedented demand for wheat and other farm products in Europe caused vast quantities to be sent from this country, and enlarged the acreage devoted to grain crops in the United States. This tended to force up the price of feed for cows, and thus increased the cost of production. Added to this difficulty was the high cost of farm labor as well as the inadequate number of laborers available; in many sections it was impossible to secure farm labor at any price. Accordingly, it became necessary to increase the price of milk, and the public, being very sensitive to such advances, especially in regard to milk, decreased the family consumption. This reacted by creating a surplus at a time when prices were necessarily being advanced in an effort to meet the cost of production. Newspapers were printing articles telling how milk was being poured into sewers and rivers, and the final result was so to aggravate the situation that organized groups of housewives started boycotts for the avowed purpose of discontinuing the use of milk in their families except for infants and small children until such time as pre-war prices should be restored.

It became necessary to point out to housewives that this plan of action would surely defeat the purpose for which it was intended, because by so doing producers would be driven out of the industry and the supply of milk reduced to the point where it would not be available at all for the poor and middle-class people; and, further, that there would be an accompanying increase in malnutrition and a reduction in growth and health standards. Herbert C. Hoover, then in charge of the work of the Food Administration of the United States, in relating his experiences in feeding millions of people in Europe, said: " Due to the denudation of cattle, milk has been unknown in many places for years. Whole populations were undernourished, but the children were suffering the most acutely from disease and malnutrition." He further said, " The white race can not survive without dairy products." In addition to the above causes, milk brought a higher price when sold for use in manufactured dairy products than when sold as fluid milk, and vast quantities of butter and condensed milk were shipped for use in Europe. Skimmed milk was being fed to animals or poured into sewers; and to check this waste, programs for its conservation as human food were put on during the war.

From these conditions grew the present programs for larger use of whole milk in the family. When the war ended, the demand for export products was greatly reduced and the existing surplus was increased. The Department of Agriculture, fearing the loss of the dairy herds of the country and a general setback to improvement of dairy cattle, which would react unfavorably on the public health, launched an educational program to disseminate knowledge regarding the importance of milk in the diet. This work consisted of a systematic, organized program adopted by various communities, both rural and urban. It was started in its present form in the spring of 1919. The United States Department of Agriculture cooperates with the extension service of the agricultural colleges in demonstration campaigns. In these campaigns the extension workers of the State are trained to conduct the work, which is then repeated, county by county, throughout the State wherever malnutrition exists and where there are county agricultural or home demonstration agents. The work is planned to reach both adults and children. It is a community project, and to get a community well organized requires time, tact, and perseverance. After the condition of the milk supply is ascertained as to both sanitary condition and quantity, a survey is made in the schools, both city and rural, to ascertain the number of children seriously underweight and their daily consumption of milk as well as their other health habits. We are aware that physical defects are responsible for much malnutrition, but when all these facts are compiled it is frequently found that where milk consumption is lowest there malnutrition is highest.

The schools have cooperated vigorously in this work. In addition to conducting the surveys before the campaign and afterwards, they have welcomed the trained speakers from the agricultural colleges or other authorized sources to give milk talks so prepared as to be suitable for the various grades of the school. Copies of these talks are left with the teachers to be repeated from time to time. The children make milk posters, write milk essays, sing milk songs, and give milk plays. Milk-feeding demonstrations are conducted, and the children who are under weight but who are free from such physical defects as would make it impossible for them to gain are enrolled for the demonstrations. In many remote rural communities medical examinations must be dispensed with. The children of the demonstration group receive their milk twice daily at the middle of each school session, and a careful record of their condition is made. Their weight, height, age, scholarship, and conduct are all noted. School superintendents have reported improvement in all of these conditions.

The mid-session milk lunch is not confined wholly to the undernourished, for in most schools, following the proof furnished by the demonstration, all children may purchase a half-pint bottle of milk with a straw and a graham cracker at a nominal price. The States of Washington and Indiana, through their State legislatures, have given official status to the milk lunch, for in both these States cities of the first class have been authorized to purchase milk for school children from the public funds, a definite per cent of the taxes being available. In the State of Washington the legislature went a step further, by authorizing the purchase of milk in school districts of the second class also. Thus have these official bodies recognized the importance of milk in the health of school children, as well as the fact that malnourished children are an economic loss to the community, and that to provide this necessity for the development of the body is as important as to provide textbooks for the development of the mind.

For adults, as well as children, the value of milk as a growth and health food is presented through talks, newspaper publicity, radio messages, motion pictures, lantern slides, bill boards, electric signs, window exhibits, menu reminders in hotels and restaurants, and in many other ways. To launch a piece of work of this kind requires careful organization. It is organized on the local committee basis, with some member of the college extension staff qualified to speak with authority on food and dairying as a member of each committee. It is the duty of the college representative to act in an advisory capacity on subject matter.

The cost of the milk campaign is small, and it is not uncommon to conduct a county-wide program lasting over a period of months for $150. The reasons for this low cost are that the permanent county home-demonstration agents and agricultural agents do this as a part of their regular work; the publications of the Department of Agriculture and State agricultural colleges have been available for distribution; and because of the method of organization and the agencies cooperating, newspaper space is given freely. In populous sections more money is, of course, required.

Statisticians tell us that in 1919 the average annual per capita consumption of milk was 42.5 gallons, but last year, 1922, it was 50 gallons per annum. Among the many factors that have contributed to this increased consumption, we believe the educational program has played a part. While the increased use of milk alone will not remedy all the health problems of childhood, it has proved to be helpful in reducing malnutrition when it is used as a part of a varied diet. In one city a survey covering 10,000 children showed that 14 out of every 100 school children were 10 per cent below the normal average weight for their age and height, and only 2 out of 5 were daily milk drinkers. The milk-for-health program was started, and two months later only 11.5 per cent of the children were 10 per cent or more under weight, and during that time the milk consumption in that city had increased 20 per cent. A county in one of our Middle West agricultural sections reported approximately 1 out of every 5 of the rural children to be 10 per cent or more under weight. Following the educational milk work, malnutrition was reduced more than half; during this period the use of milk was materially increased.

In one of the far Western States a number of feeding demonstrations have been conducted. In order to interest the children these are called "Keep-growing demonstrations." Just four points are emphasized: A quart of milk a day, two vegetables, a cereal for breakfast, and 10 hours of sleep. A nutrition worker from the college made four trips to one of these communities. The nearest doctor in the community was 40 miles away. There were plenty of cows, but the children were not using milk previous to the demonstration. In this special group 74 children were examined, and of this number 66 completed the demonstration, which lasted over a period of nine months. Before the demonstration 35 of the 66 were in the normal zone; at the close of the demonstration it was found that 57 out of the 66 were in the normal zone. Instead of 29, only 4 were 10 per cent or more below normal, and 5, instead of 2, were over weight. The total number of children who gained in weight was 64 out of 66. The total amount gained was 431.5 pounds, an average of 6.7 pounds per child.

The cooperation of the local people in these demonstrations was excellent, through both schools and church societies. In the rural work it is not uncommon to stage such demonstrations many miles away from a doctor. I have on my desk a report of a demonstration which was conducted 70 miles from a doctor. It is obvious, therefore, that if these children, so remote from health centers, must wait until they have had a doctor's examination their condition of malnutrition will not be remedied during their lifetime. In most of these rural districts there is plently of milk, but it is being fed to livestock or sent to creameries for the manufacture of dairy products. The farmer pays high transportation charges in shipping to cities a valuable food product which is sold at wholesale rates. Less valuable food is then shipped in to these remote communities at high retail prices and large expense for transportation.

The number of children who complete the "keep-growing" demonstration is large. In one of these remote communities where 97 children were examined, 96 completed the demonstration, and the ratio of improvement compared favorably with the illustrations already given.

The effectiveness of a milk-for-health campaign varies as a rule in accordance with the interest and work contributed by the citizens themselves. The United States Department of Agriculture has only two milk campaign workers but by the plan of training State extension workers, who in turn train local leaders to conduct milk-for-health work in their own community, results are very far-reaching, and thus the work goes on in an ever widening circle. Already the United States Department of Agriculture has launched this work[2] in over half the States of the Union.

The value of milk in the diet is summed up by Dr. C. F. Langworthy, formerly chief of the Office of Home Economics, United States Department of Agriculture, when he says: "Good health demands plenty of milk. It supplies the body with necessary materials in exceptionally healthful and economical forms. An abundant supply of milk is of national importance."

SUMMARY.

The outstanding points of milk-for-health programs as conducted by the United States Department of Agriculture are:

1. Through the training of leaders to convey the message of milk as a food, the work of a few is multiplied many thousand fold.

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[2] For more complete information and illustrations, see U. S. Department of Agriculture Circular No. 250.

2. The campaign is conducted over long periods of time because it is handled by the permanent extension workers of the agricultural colleges.

3. The local expenses are small because the work is done as a part of the regular duties of the extension staff.

4. The results in reducing malnutrition are readily measured through school surveys.

5. The increased consumption of milk is reported at regular intervals by the dairymen; these records show a consistent and continuous increase in milk consumption.

Chairman STANLEY. Are there any questions you would like to ask Miss Hoover?

It is very fitting that we should have, to present the last paper, Mr. Munn, president of the National Dairy Council, who will speak to us on the educational work of the National Dairy Council. [Applause.]

THE WORK OF THE DAIRY COUNCIL.

M. D. MUNN, president, National Dairy Council, Chicago, Ill.

Ladies and gentlemen: I am quite well aware that you have been sitting here some time and are doubtless weary. I have confidence that what I have to say I will say in as brief a space of time as is possible.

As you have already observed, there are several lines of activity in carrying on this educational work regarding the food value of milk and dairy products. Three and one-half years ago the National Dairy Council began its active work in carrying on this educational program. And we have had considerable experience growing out of that work, and the questions that have been asked me since Philadelphia day, when we attempted to make a display of our activities and to show in part how we carry on this work, lead me to believe you wish to have something of the detail rather than general conclusions on the subject.

So I am going to give you, as briefly as possible, the details of our organization work, and how we carry on this work.

The paper you have just listened to, so splendidly presented by Miss Hoover, shows you the work of the Dairy Division of the Department of Agriculture. We work in the larger cities and communities with longer campaigns. We endeavor to put on a campaign covering a period of at least one year, preferably three years, in order to get the foundation laid and to fix the habits based on that foundation so they will carry on. We work through several agencies. We work through the schools on the theory that the child is the most available avenue through which to reach the parent. The school makes it possible to reach the largest number in the briefest time. We work next through the educational and health organizations of the city. We work through the parent-teachers' and mothers' club organizations and any other civic welfare organization that is available in the city. We have endeavored to put our work on such a high plane that we can solicit and receive the cooperation and support of all welfare organizations, both national and local. We have succeeded in doing that, and these national welfare organizations such as the one, for instance, represented by Miss Jean, whom you listened to in Philadelphia, cooperate with us heartily and render great aid.

Now, what method do we adopt in carrying on this work through these agencies? We believe that the child must be reached through the fanciful or imaginative appeal. A child is not interested in cold facts, but all children can be reached through the fanciful or imaginative avenue. Therefore, we try to dress our work in a form which will enable us to reach them through those avenues.

The result is, we have plays where children take fairy characters, we have story telling where we use fairy characters and fanciful illustrations, always confining ourselves to the truth, but clothed in fanciful form.

Then, we begin putting out material with this educational work through fanciful form in which we tell, either by narration of a story—still in fanciful form—or a simple statement of fact, illustrated so as to attract the attention, in which we always have the story of the food value of milk and dairy products. The result is, that these children are immediately interested. They go home and tell their mothers of what they have heard or what they have seen in school. They repeat it again the next day, and the mothers begin to inquire where the children got this information and what it means, and the children come back to the school and ask the teacher about it or the mothers question the children and find out about it, and soon they are interested and ardently advocate that children, their own children, consume more milk. We find this method the most effective way of doing this work.

Then we follow it by material intended for the consideration and digestion of the parent, a little more substantial, a little more direct, not so fanciful. Then we come along next with our moving pictures and slides. We use those in the schools and the children take the message home and the mothers come back to see that picture or see that slide and again get the lesson.

We carry this all through in order that we may lay the foundation which I spoke to you about when I began. You can't build a habit in a day. The kind of food we eat is largely the result of habit, and you can't change the system of feeding in one day. It is the hardest thing we have to change, because the parent has this lifelong habit of eating less of the desirable and more of the undesirable food. The children pick that habit up from the parents and you have to overcome two, the child and parent, a human inertia most difficult to overcome. Therefore, we feel we must carry this work on, not by weeks, not by months, but by years, building a new habit in the parent and building a desirable habit in the child.

Those of us engaged in this work believe we are accomplishing a two fold purpose in doing that. We are not only attaining results to-day so far as the health of the children is concerned and the efficiency of the parents, but we are building a foundation with the child to be carried over to the next generation, because the boys and girls to-day are the fathers and mothers of to-morrow. And those children, with this strenuous work we are now carrying on in the education of the present-day children, will not have to correct this habit as parents.

The plays we find extremely useful because we not only put over a message in the play in a form which fixes itself in the mind of the child and parent, but we enlist the interest of the parent. Maggie Murphy is informed that her little girl is going to take part in a play in school. Now, Maggie Murphy becomes interested at once in the fact that her child is to appear on the stage in a play in the school. She tells her neighbor, her next neighbor, her relatives, and she asks them all to come and see her little girl take part in the play in school, and we thus bring into that school to see that play a large number of adults in addition to the parents of the girl. And they get the message. They become interested, and thus give these plays more far-reaching results, perhaps, than almost anything we can do.

Now, we always supplement these activities by what we call local interest material. Our nutritional experiments carried on in Philadelphia have not the personal touch or interest in St. Paul that the same kind of experiments carried on there have. We seek all the time to have the newspapers to tell on the front page as news what we are doing rather than to get paid advertisements in the paper. We find that of great value. Therefore, we get what we call local interest material so the local paper will take it up and publish it as a piece of news, local news, and we always find they do that because of the new interest, together with the local news object. While we have almost inexhaustible funds of information on this nutritional work, we keep establishing new local demonstrations for the purpose for which I have outlined.

The next thing we find most effective is the story telling, where we weave around these facts the fanciful narration, picturing, as you saw in Philadelphia, the fairies, the protein fairy, the butter fairy, the vitamin fairy, the mineral matter fairy, so the child, not understanding anything about the vitamin, mineral matter, etc., as such, seeing this fanciful presentation of what they mean, forever after retains it in its mind. At the same time the child associates it with the fact that that particular element in the food does him good.

We make the appeal to the boy on the idea that the boy always wants to be strong and athletic, and these foods will make him so. We picture that in the play. We appeal to the girl who wishes to have bright eyes, rosy cheeks, glossy hair, and healthy looks. We picture that. We find the lesson so gripping to these children that when we go back with a request for a poster or an essay it is always forthcoming, and we see as a result that our message has become impressed as a fixed thing in the mind of the child.

The moving picture, of course, is an entertainment, but we always have with that a lesson. The child, in turn, is held by the picture, as there is enough of the human interest or the fanciful woven into that picture so the child associates it with milk and always remembers it.

Then we ask the children to prepare essays, or if they are artistically inclined, posters, and we offer them small prizes in the schools for those presenting the best essays or poster. We avoid as much as possible giving monetary prizes to the child. We get hold of the child's interest in the school. In other words, the child is doing it for the school, not for himself, thus creating that school spirit that all children have, more or less, and thus getting the interest of the teachers in the school by featuring the school as having won a prize. We get marvelous results from those posters and essays.

In St. Paul we have had a child health essay contest and a child health week. We had the fanciful side of this presented and then we asked the pupils of the high schools to prepare epigrams for a contest, with prizes to the schools, as I have outlined. We published a little book of those epigrams known as the Sayings of Three Wise Schools. We selected the best of hundreds of sayings and made the awards to the schools having the largest number selected. We got this book all prepared by these children, and they are all based on health rules and emphasizing the food value, thus, you see, enlisting the interest of the children.

In addition to educational work, we carry on or are carrying on what we think is a very valuable work which touches directly upon the milk dealer's and producer's end of the industry. We carry on quality control work. We believe there is a dual obligation in this industry. We believe it is an obligation of those who produce milk and dairy products to supply the consuming public the very highest grades possible. Then we believe there is an obligation on the consuming public to pay a price for those products that will insure and justify their production. We are trying to build in the minds of the consuming public the quality idea and at the same time educate the producer to produce and to help market that quality product. To my mind that is the keynote that we should adopt in this industry—quality as a basis for advancement.

Now, we do this quality control work by having men who go out among these farmers and explain to them how they can improve the quality of their milk; show them why it is going to be of benefit to them; point out to them the condition of the milk they are shipping in; explain to them why it is so and how it can be improved. The results are surprising.

In one locality, a short time ago, there were four or five farmers who were shipping a quality of milk that was far below what it should be. The neighbors of these farmers were trying to improve the quality and had succeeded in improving it. We showed the first group of farmers just what had happened and urged them to improve the quality to conform to the neighbors' milk. The neighbors took it up and said to these men: "If you ship your milk with ours you must come up to our standard." Thus we secured the co-operation of the producers themselves in helping us to improve, all along the line, the quality of the product they are putting on the market. I think that is invaluable work.

We still find another thing which is necessary. In some localities where we have been asked to come in to carry on education work the condition of the supply of milk did not justify educational work. We will not, as an educational organization, attempt to put on a campaign to educate people to consume more milk unless there is a supply of milk adequate in quality available in that communtiy. As a result we find it necessary to go in and help a local community to clean up those conditions and secure, if necessary, municipal or other measures requiring improved quality, such as Pasteurization or the inspection of the dairies and a standardization that brings into that local community the kind of milk that should be distributed under our education. That work is growing rapidly in our organization.

I refer to these things to show in a general way what we are doing and how we are doing it.

Doubtless many of you are asking yourselves: "What are the results obtained? Is the council accomplishing the things that it has aimed to accomplish?"

In answer to this question I am glad to say that the results are far beyond what we had expected in the first instance. You must bear in mind that the educational work of the council covers but a comparatively short period of time. It is only within the past few years that the vital food value of milk and dairy products has become known. The field of science through research work has demonstrated during the past five years that this product of the dairy cow is vital to human welfare. Our work has necessarily followed, rather than preceded, these scientific research conclusions.

In the begining of our work we were in doubt as to the best methods. It required a great deal of experimentation and, necessarily, some failures resulted before we could finally determine the most effective methods of carrying on the work.

We are now working along well-organized and established lines of procedure, and the results which follow even amaze these engaged in the work.

In Philadelphia you saw a display in one of the large schools in that city. In the beginning we had to solicit the opportunity of going into a school or any educational institution in order to make our display and to help the teachers teach the children how to be healthy.

Our work has progressed so rapidly that now, instead of soliciting the opportunity, we have difficulty in meeting the demands made upon us by the schools of the country.

What a great and inspiring thing it is to be invited over the threshold of the schoolroom to help those engaged in teaching the children, and to be able to show that by using more of the products of the dairy cow in connection with the observance of health rules the children would be far more healthy. What an obligation this places upon the dairy industry. How important it is that we should have ideals that we live up to in helping to teach and train these children who are soon to become the men and women upon whom the hopes and successes of the Nation depend.

We always have and always shall strive to reach and maintain those ideals; and I say, without fear for the future, that all those engaged in this great and vital industry, whether in production, manufacturing, or marketing, are rapidly coming to see that this great ideal must be kept ahead of the industry, rather than that the industry should be essentially commercial, with the ideal trying to follow on behind.

Ladies and gentlemen, there never was presented to men and women engaged in any industry or occupation such an opportunity as is presented to this industry and to those engaged in this educational work as well as to those engaged in the industry itself.

I would be recreant to my sense of justice and duty if I did not at this time emphasize again what I have said on many occasions, namely, that this great work of the National Dairy Council would be hopelessly lost were it not for the fact that these young men and women engaged in doing this great educational work of the council are inspired by a wonderful ideal of service. They are so deeply interested and absorbed in their work, they so realize its vital importance to those with whom they live and the children that are coming on, that it seems almost as though a Divine Providence had said to them, "Go, thou, and do this work for Me."

It is these young men and women who have made the work of the National Dairy Council a success, and who are bringing these results forward so splendidly.

Chairman Stanley. Have you any questions which you would like to ask Mr. Munn before he escapes?

We have now just five minutes for discussion. Has anyone a very important question he would like to bring up? We should have to limit the discussion to one minute, I think.

Mrs. Watson (Montreal, Canada). I'd like to know if it is good to give children milk in the form of puddings; any kind of puddings.

Chairman Stanley. Mrs. Watson asked a very pertinent question, that we shouldn't emphasize the use of raw milk. She has asked whether it is just as valuable to give it in other forms. Will you answer the question, Doctor Brown?

Doctor Brown. While we are agitating very widely the consumption of fluid milk, anyone working actually with children knows that you have to advocate mixing it. As to your direct question, I undoubtedly feel that substitution in cooking is an important thing if you get the milk into the child and into adults in some way.

Chairman Stanley. Are there any other questions? If not, I think that concludes our session this morning.

(Adjournment.)

SESSION 14. COOPERATIVE MARKETING OF MILK.

Honorary chairman, A. POOLE WILSON, chief inspector of dairying, Department of Agriculture and Technical Instruction, Ireland.

Chairman, F. P. WILLITS, secretary, Pennsylvania State Department of Agriculture.

Secretary, GEORGE P. GROUT, head of the department of dairy husbandry, Agricultural and Mechanical College of Texas.

STRAND THEATER,
Syracuse, N. Y., Monday, October 8, 1923—9.30 a. m.

Chairman WILLITS. The meeting will please come to order.

The first paper will be by R. Manod Owen on "Cooperative dairying." [Applause.]

COOPERATIVE DAIRYING.

R. MANOD OWEN, dairy organizer, Welsh Agricultural Organization Society, Llagerniew, Abergele, Wales.

Successful cooperative dairying is guided by certain principles, the adherence to which insures success whilst departure from them invariably leads to failure.

Let me enumerate a few of these principles:

I. *A cooperative dairy should be a purely farmer's or milk producer's society.*—No one should be admitted as a member who does not possess, at least, one cow. If nonmilk producers are admitted as shareholders, or members, their interests are bound sooner or later to clash, and trouble follows. I have known of several societies which have come to grief on this rock.

II. *A cooperative dairy does not buy milk.*—It ceases to be cooperative if it does do so. This principle should be clearly understood—it means that a society can not promise in advance a definite price for the milk supplied. The milk is only received by the society for cooperative treatment and sale, and until the sale is effected and the costs of management ascertained, the ultimate value of the milk supplied to the dairy can not be known. Before paying out, whether it be fortnightly or monthly, the average selling price should be ascertained and a part payment made to the suppliers equal to three-fourths of the average selling price. Thus, if the average sale price for the month has been 1 shilling per gallon (approximately 10 pounds of milk) you would pay out 9 pence per 10 pounds or 7 shillings 6 pence per 100 pounds for milk which contains normal butter-fats, say 3.5 per cent. If a supplier sends in milk which is 3.6 per cent he would get 7 shillings 8 pence; 3.7 per cent, 7 shillings 10 pence; and so on. Two pence per point is added for milk above 3.5 per cent and milk below 3.5 per cent is reduced by 2 pence per point. The one-fourth retained is, after providing for interest and reserve, divided out annually to the suppliers on the basis of quantity and quality supplied by each one during the year.

III. *Interest on capital must be a fixed interest of, say, 5 per cent.*—My practical experience in cooperative dairying is in the main confined to my own country—Wales—and my experience teaches that there must be no deviation from the foregoing principles if a cooperative dairy is to succeed.

Prior to 1917 cooperative dairying was, with one or two exceptions, unknown in Wales. In that year the Ministry of Agriculture introduced a scheme which has done an immense amount of valuable educational work as regards the value of cooperative effort. The scheme provides a demonstration—loaning the utensils and a qualified instructor to any rural district prepared to provide a suitable building and the requisite quantity of milk daily, for a period of not less than three months.

Somewhere about 40 centers in North Wales alone availed themselves of the scheme, and from these demonstrations has sprung a number of duly registered cooperative dairies having a central scheme of accountancy and control.

The capital is raised by the issue of £1 shares.

Cooperative dairying is a great boon to the small farmer, of which my country is largely made up. In point of fact, it is his only salvation. The large farmer by virtue of his greater production is independent of the economic problems of adequate equipment and transport facilities, whilst the small farmer is solely dependent on the cooperation with his neighbors to overcome these difficulties.

May I illustrate this by describing one of our typical cooperative dairies, of which I happen to be the secretary?

Our village is situated at the head of the beautiful vale of Elwy in Denbighshire, some 700 feet above the sea level and 10 miles from the nearest railway station. It is the month of May, and the morning is fine. At 7 o'clock vehicles of every description begin to roll in with the milk from 30 or 40 farms, within a radius of 2 or 3 miles. By 8 o'clock the last supplier has arrived. One hour is allowed for delivery. The hour has been full of incident and great good humor. Frequently much more business has been done than that of merely delivering the milk and taking back a supply of whey or separated milk. Many a bargain has been struck and appointments made.

"I'll see you at the factory in the morning" has become a byword here and has excited the muse of our local poet, the result being a popular song of which this phrase is the burden: "I'll see you at the factory in the morning."

Our dairy is equipped to deal with 600 gallons per day. Some of the 30 or 40 suppliers bring in as little as 10 pounds of milk, and the highest is seldom over 400 pounds. Every supplier receives a receipt the duplicate of which is sent to head office. Every supplier's milk is sampled. The point I want to emphasize is that it is only by a cooperative effort that the small farmer can possibly overcome the economic difficulty of the 10 miles transport of his milk or milk products, and it is only by a cooperative effort that he can economically equip and engage competent hands for the treatment of his milk and the manufacture of his milk products.

There are many advantages besides the foregoing which the producer reaps from cooperative dairying.

He benefits by the reduction of the work at home on the farm and from the troubles and worries of marketing.

This benefit enables the farmer to concentrate more on production and it emancipates to a great extent his womenfolk. The primitive method of hitching his horse to the trap to take a few pounds of butter on market day 10 miles distant, to spend the day heckling over the price, may be picturesque, but it is certainly not economical either to himself or the consumer. His market is broadened by a cooperative effort. Without it he is limited to his local market town; by its aid bigger and better markets come within his reach, for cooperatively he has more to sell, more bulk, whether it be liquid milk or milk products; it is a bulk sufficient to entice the notice of the great wholesale buyers and distributors.

But perhaps the greatest benefit to the producer is that by a cooperative effort he secures that which the best markets demand.

UNIFORMITY OF QUALITY.

The great drawback hitherto with Welsh dairy products has been lack of uniformity of quality. How could it be otherwise when each farm treated its own milk in its own way, and often under great difficulties—lack of a proper water supply, lack of a trained dairymaid, and an inadequate dairy, badly equipped.

May I again illustrate these advantages of a better market and uniformity of quality, from the experience of our cooperative dairy?

Prior to its establishment in 1917, its 40-odd members treated their milk at home. The amount then produced was naturally small, there being no outlet. No whole milk was ever put on the market. What little was produced was converted into butter or fed to young stock. Farming here had fallen into that rut known as farming with "a dog and a stick," which means that the whole of the land was practically given over to sheep.

Since 1917 this cooperative dairy sends milk daily to large centers of population 50 and 60 miles distant, and its cheese finds markets much farther afield. The sampling and testing and payment on grade secures quality and purity, and the cooperative treatment by a trained staff secures uniformity, and these two achievements secure a better market. That is our experience.

These are some of the advantages accruing to the producer from cooperative dairying. The advantages (or benefits) which the consumer reaps are obvious—improved quality, uniformity, and hygienic treatment under hygienic conditions, the reduction in cost of production, a part of which is undoubtedly passed on to him, and a steadier supply.

I am afraid my paper would be far too long were I to dwell upon the "national view" of cooperative dairying, the overcoming of the problem of "sours." It is said that the loss from milk turning sour in transit amounts to over half a million sterling per annum. I can see a remedy for the major part of this evil in cooperative dairying—that is, in the type of cooperative dairying that I am in touch with and advocate.

(1) I maintain that milk should be treated at the nearest point to production, if the "perfect product" is to be obtained. That is why I favor small village cooperative dairies to huge factories at from 10 to 20 miles distant from the point of production. No village or district is in my opinion properly equipped that is without its cooperative dairy. Milk is so delicate a product that it should be submitted to the least possible handling, and I hold that every mile it is jolted along the road damages it to some extent, and damaged milk can never be repaired.

(2) Milk is so essentially a national food that the industry should be highly organized and every available source of supply tapped in hill and dale, so that in the event of a crisis like that of 1914–1918 recurring, the nation should not be at the mercy of a haphazard supply of a badly organized industry. It may be argued that small village cooperative dairies are not a "business proposition." That five or six hundred gallons of milk per day will not warrant expensive equipment or an efficient staff.

That is not my experience. Expensive equipment is in my opinion largely unnecessary where cleanliness rules at the source of supply; and if this is backed up with an efficient staff and management, then village dairying becomes a sound business proposition.

Cooperative dairies of the type that obtains in Wales can and are worked under 2 pence per gallon. This 2 pence covers all expenses—rent rates, taxes, wages, interest on capital, etc.

A staff of two can deal with 500 gallons per day during the cheese-making season, whilst one can easily manage during the winter milk selling period.

One of the difficulties that faced me at the outset was to find in a country village competent secretaries with a sufficient knowledge of accountancy to keep the books in proper order, and this difficulty led to the establishment of a scheme of central accountancy. We have now a central office with an efficient accountant in control that does all the accountancy for a penny in the pound on the turnover of a society.

If a society sells say £6,000 worth of milk and milk products during the year, then its accountancy would only cost £25. Daily returns are sent in from the dairies to the central office, at which all the principal books are kept, the dairy only being troubled with a triplicate milk receipt book, a cash and credit sales book, receipt book, and petty cash book. The books are all specially designed and standardized. Periodical visits are paid from the central office to inspect the local books and instruct the manager when necessary. In addition to the accountancy, the central office also buys in bulk, at wholesale prices, all dairy requisites in the interest of the dairies.

The central office also organizes a dairy show each year. These shows have been most successful, not only as an incentive to the dairies to improve production but also as a means of advertising the products to the consuming public.

The central office is careful not to replace local initative and interest, but rather to foster it. Cooperative dairying is essentially democratic as regards management, and under certain circumstances this virtue is a source of trouble which the central office is often called upon to correct.

Few farmers are convinced cooperators and are seldom able to distinguish between cooperative principles and commercialism. They also, as a rule, lack in loyalty to their society. Still I believe that things are getting better in this respect.

The hope of the future lies with the better educated young farmer—the product of our universities and farm institutes. Cooperative efforts in all branches of agriculture will stand a better chance when jolly old Hayseed and Giles have been gathered to their "rude forefathers."

Chairman Willits. I am sure we appreciate that very much. Are there any questions?

Mr. G. Clark (Des Moines, Iowa). You spoke about these creameries being in charge of an experienced dairymaid. Do I understand that your butter maker over there is a woman?

Mr. Owen. These are such small concerns we can seldom afford to pay a man's wages. Nearly all the dairies are managed by trained women from our universities; they are cheaper, I am sorry to say, but that is a fact.

Mr. Harris. I would like to ask in regard to the feed. You speak of the wet there. You have no trouble about the pastures?

Mr. Owen. We have excellent pasture in the hills of Wales. If anything, we have too much water. I understand you are short of it in America, that you are extremely dry. [Laughter and applause.]

Chairman Willits. The next paper will be by Mr. E. W. Langford on "Work of the National Farmers' Union in connection with milk organization in England."

WORK OF THE NATIONAL FARMERS' UNION IN CONNECTION WITH MILK ORGANIZATION IN ENGLAND.

E. W. Langford, J. P., past president, and chairman of the milk and dairy produce committee, National Farmers' Union of England and Wales, Hereford, England.

The National Farmers' Union, which operates in England and Wales—Scotland has a union of her own—is a young organization. The task of organizing a scattered community must be a difficult one anywhere, but it is particularly so where, as in England, urban interests predominate. Had the farming interests of England been strongly welded together two generations ago, the industrial history of the country might have been written differently. Unfortunately such organization as existed in these days was sparse, local, and irresolute. Agriculture declined as an industry and the State was indifferent to the process, and it was not until the early years of this century that a farmers' organization came into existence the leaders of which had the courage and imagination to work for the extension of the movement to every county of England and Wales, and the establishment of national headquarters in London. They persevered and attained a certain measure of success. Even so, when the European war broke out, the National Farmers' Union could only claim some 25,000 members, who were far from representing the whole of the country.

The war gave an impetus to organization, by reason of Government control, which made it imperative that farmers should have an effective body to voice and protect their interests. By the time the armistice came, the National Farmers' Union had more than doubled its strength, and more ample resources made it possible for those who were directing the union's activities to grapple seriously with the task of spreading the gospel of organization. An efficient "machine" was built up at headquarters in London and successful efforts were made to "grade up" the branches which now exist in every county south of the Tweed, with some 800 local branches scattered through the counties.

It is necessary to state these facts in order to show why, in the very nature of things, the work of the National Farmers' Union in the way of milk organization does not make a lengthy story. The work of the union, indeed, is in its infancy, and those of us whose privilege it is to be associated with it are sitting at the feet of those whose experience in other lands, by reason of greater opportunity, is larger than our own. We are seeking to gather knowledge and to apply the knowledge when gained to the problems which confront us.

Another fact should be made clear at the outset, namely, that the National Farmers' Union is not a trading body nor is it any part of the union's functions to establish agricultural trading societies. On the other hand, it ought, perhaps, to be stated that the experience of the usefulness of collective action which our members have gained within the ranks of the union has led in a great many cases to the establishment independently of cooperative enterprises for different purposes in many parts of England and Wales.

What, then, are the conditions that the milk and dairy produce committee of the union has to face in seeking to promote the interests of the dairy farmers of England and Wales? They may best be described in the words of a recently published report of the departmental committee on the distribution and prices of agricultural produce:

> Until the beginning of the present century, nearly all fresh milk passed direct from the cow keeper to the consumer, or passed through the hands of a single distributor who bought from the producer and retailed direct to the consumer. To-day, London is a striking example of the other extreme. It has been computed by recent investigators that the milk supplies for the population residing within a radius of 10 miles from Charing Cross are almost exclusively drawn from outside a ring of 40 miles radius, the milk produced in the intervening belt being no more than sufficient for local requirements, while, to an increasing extent, these supplies tend to pass through the hands of two distributors. As the demand for milk increased and it became necessary or economical to obtain supplies from ever-widening areas, personal contact between producer and consumer, and even between producer and retailer, was largely eliminated. * * * To bridge this growing gulf, the business of the wholesale dealer developed. In many parts of the country, even in the more important towns, the wholesaling of milk is a development of the last decade or so. In London, the history of the wholesale trade does not extend far beyond the beginning of the present century.

Before the war, as has been indicated above, there was very little organization among the dairy farmers of this country. Each man did what he considered best for himself, and as a consequence the purchaser of milk was able to play one off against another, with the result that prices ruled low. This was particularly the case during the summer season, as it was customary for all milk then to be purchased at the cheese-making price, i. e., at such a price as would enable competition with the imported cheese supplies which we were then receiving from Canada and elsewhere.

With the war came an increased demand for milk to meet the requirements of the large number of sick and wounded who were constantly arriving from the battlefields of Europe. Owing to shortage of labor on the farms and to the poorness of artificial feeding stuffs, the yield per cow decreased, and it became necessary, therefore, to look for fresh sources of supply. The Ministry of Agriculture initiated propaganda in many of the more remote agricultural districts where up to then all the milk produced had been utilized for butter making and calf raising or for cheese making and pig feeding, impressing on such producers the advantages of selling some if not all their produce as liquid milk. The Ministry of Food also stimulated milk production by fixing prices based on cost of production, and the large wholesole dealers did much to render such supplies available by arranging for the collection of the milk from the farm. In these ways the increased demand was supplied.

The National Farmers' Union had not up to that time taken any very active part in the organization of the milk industry, but, with the fixing of prices by the Ministry of Food, it became necessary for somebody to undertake to place the producers' case before those responsible for the fixing of prices, and the union, as the premier organization of farmers, undertook the task. The "control" period extended from April, 1917, to January, 1920, inclusive.

With the decontrol of prices there appeared a danger of milk selling again reverting to the pre-war conditions. The union, however, had been in touch with the distributive trade and endeavored at each six-monthly contracting period to come to some general agreement with the trade with regard to prices.

In September, 1920, the union appointed 15 representatives to meet an equal number of representatives of the distributors to submit the views of producers regarding winter milk prices. This meeting proved abortive so far as any agreement in regard to prices was concerned and, the distributors having met independently and fixed their own scale for the period October, 1920, to March, 1921, it was left to producers to obtain the most satisfactory prices possible from buyers of milk by individual arrangement and united action through the county branches and groups of county branches of the union.

Profiting by experience, the union next year agreed to the formation of a joint committee with the National Federation of Dairymen's Associations to deal with matters of interest to the milk industry. Within the ranks of the union itself, each county branch was asked to set up a county milk committee, which in turn sent delegates to "area" milk committees and the area committees sent delegates to the central committee at headquarters. The branches were urged to exhaust every effort to "recruit" all the milk producers who were still outside the union.

The establishment of this system of committees naturally served a useful purpose in the way of increasing the flow of information through the channels mentioned to the union's headquarters. In 1921 industrial depression was acute, and the consumption of liquid milk fell off with the decreased purchasing power of the community. Supply exceeded demand, and large quantities of milk had to be purchased for conversion into goods. Manufactured milk products showed a great decline in price. In such circumstances it is no matter for surprise that the milk prices fixed for the summer and autumn periods were not altogether satisfactory from the producers' standpoint, and the union felt compelled to ask its members to examine the question of whether milk production at then ruling prices offered a remunerative return on capital and labor invested.

The winter of 1921–22 was a favorable winter for milk production, and the distributive trade had been faced with a large amount of "surplus" milk which they had had to convert into products at a considerable loss, for those producers who had come into the liquid milk trade during the war had not reverted to their previous methods of disposal. In order to recoup themselves the distributive trade endeavored, when spring contract time came, to lower the price of milk to such an extent that it was clearly evident that producers would be faced with serious losses. On the advice of the union, milk producers all over the country withheld all "surplus" milk.

The demand had increased, owing to the lower retail price at which the distributive trade had stated they were prepared to sell, and supplies were not forthcoming to meet it. The result was that after abortive negotiations had taken place between representatives of producers and distributors, following the intervention of the Ministry of Agriculture, a meeting was held at the headquarters of the National Farmers' Union in London and an agreement was reached by which prices to the producer were raised by 2 pence per gallon. This, being the first agreement made between the distributive trade and producers, was regarded as a victory for collective bargaining.

During the summer of 1922 the union and the distributive trade met each month to discuss difficulties which arose and also to endeavor to find some method by which agreement could be reached when the time came for making winter contracts. Members of the union were prepared to rely upon collective bargaining by their central milk committee, and they desired to make contracts for 12 months. After many schemes for fixing prices had been considered and reluctantly rejected for various reasons, the union eventually decided to put forward the scheme which was ultimately adopted by both parties, the main outlines of which were as follows, and were based to a large extent on successful American practice:

That contracts should be for 12 months from October, 1922.

That November, December, January, and February should be regarded as basic months and that all milk supplied during those months should be paid for at liquid-milk prices and be known as the "basic" quantity; that all milk sold in October and February should, so far as the basic quantity was concerned, be paid for at liquid-milk prices, but that anything over and above that quantity should be paid for at manufacturing price; that for the summer months, the basic quantity plus 10 per cent should be paid for as liquid milk, and all further quantities at manufacturing price.

After much discussion these ideas were adopted, and it then became necessary only to fix the price of winter and summer liquid milk and to ascertain how the manufacturing price was to be arrived at. The prices eventually fixed were 1 shilling 8 pence per gallon (of 10 pounds) for the winter, and 1 shilling for the summer months, for liquid milk delivered London, and it was decided that the manufacturing price should be ascertained month by month by taking the average price of Canadian and New Zealand cheese, and deducting 2 pence, the cost of manufacture.

This scheme, whilst not giving satisfaction to all, has worked with wonderful success, and although the union can not claim even yet to have the milk producers in the country in its ranks, yet many who are not active members of the organization have made contracts on the terms negotiated by the union. The departmental committee set up by the Ministry of Agriculture to inquire into the distribution and prices of agricultural produce accepted the principle of collective bargaining as sound and recommended that it should be maintained. They also emphasized the importance of the method of buying excess supplies on the basis of their potential value for manufacturing purposes.

Before leaving this subject, it may be noted that the distributive trade have done their best, as have the producers, to give the scheme a fair trial, and that there now exists much better feeling between the two sections of the industry.

Another phase of the union's activities is directly related to the matters just discussed. Our difficulties in connection with the problem of "surplus" milk have been and are in a large measure attributable to the underconsumption in Great Britain of liquid milk and home-manufactured dairy produce. The importance of this question was so borne in upon the milk and dairy produce committee of the union that last year we summoned a special conference of representatives from all our county branches to consider the subject

The upshot of the conference was that it was agreed that a milk publicity campaign should be inaugurated. A National Milk Publicity Council came into being, on which representatives of the union were appointed, and we made a contribution toward the initial expenses involved. The publicity council drew up a scheme under which its activities were to be financed by equal contributions from producers and distributors on a basis of gallons sold and bought. It is too early yet to prophesy in regard to the results which will be obtained from milk publicity, but it can be said with confidence that there is a growing appreciation of its importance on the part of our Ministries of Health and Agriculture and of public authorities generally, and that, so far as the union and the distributive trade are concerned, vigorous efforts will be made to establish the indispensability of the work of the National Milk Publicity Council in the best interests of all concerned.

It is not, perhaps, out of place to mention here, as illustrative of the union's attitude toward milk organization problems, that last year the national executive invited me, as chairman of the milk and dairy produce committee, to visit North America to examine and report upon the conditions relating to the production and distribution of milk obtaining in the United States and Canada. This I did in company with the medical officer of health for the city of Birmingham and a gentleman who is engaged in the distributive trade. By reason of the great courtesy shown to us everywhere during the progress of our tour, and, so far as I was concerned, thanks to the expert knowledge in their respective spheres of my two colleagues, I brought back to England a fund of useful information, which I have since endeavored to utilize in the work of my committee, as witness the milk scheme above mentioned. The union published 30,000 copies of my report on my tour, and these were distributed widely over England and Wales.

In my report I venture to point out that—

> It should be fully realized that if the industry bases its claims for an increased consumption of milk upon the position of milk as a necessary article for the national well-being, then it must also be prepared to accept the right of the public to a full knowledge of the essential facts of the industry and a sense of security that, both from a hygienic and an economic point of view, the industry is being conducted upon sound lines.

These words indicate, very broadly, the lines upon which the milk and dairy produce committee of the National Farmers' Union is working in the interests of the milk industry in Great Britain. The union is in constant touch with the National Clean Milk Society in order to promote production under the most hygienic conditions and also supports the work of the milk recording societies.

A highly important sphere of the committee's work is that in connection with legislative matters. The union is the only organization of agriculturists in England and Wales that is thoroughly representative of all parts of the country, and as a natural consequence, ours is the responsibility of watching parliamentary proceedings and maintaining touch with Government departments. As an illustration, the milk and dairies act which became law last year may be quoted. This act, among other things, postpones for a further three years a consolidating act passed in 1915, the operation of which had already been postponed during the war. We had previously given exhaustive consideration to the directions in which amendment of the law was likely to be sought, and we laid our views before the Ministry of Health when invited to do so. During the progress of the 1922 bill we had more than one consultation with the ministry and secured important modifications of its provisions as a result of these consultations as well as through amendments tabled at our instance in both chambers.

The provision of legal assistance to members is a growing feature of the union's activities and has been of material value to many dairy-farmer members. A milk contract form was prepared under the supervision and, with the approval of our legal adviser, submitted to the traders. The form is now widely used.

The question of transit facilities naturally looms large, having regard to present-day market requirements. The departmental committee whose report has already been quoted, came to the conclusion that "transport facilities in this country have not kept pace with the modern developments and requirements of the (milk) industry," and expressed the view that—

> Lower railway charges on milk would be of the greatest national advantage in encouraging an increase in consumption, and therefore, in railway revenue. The companies should review the present scale of rates in this sense.

These views simply fortify those previously expressed before the railway companies by representatives of the National Farmers' Union, who pressed for such reforms as the speeding-up of milk trains, the provision of properly ventilated or refrigerator vans for the conveyance of milk, the use of vans exclusively for conveying milk, and the reduction of carriage charges. Certain concessions have been granted in consequence of the union's representations, but more remains to be secured.

The foregoing is no more than a brief survey of the main heads of the union's work on behalf of dairy farmers. It covers a comparatively short space of time, during which farmers have attached themselves to the organization in increasing numbers. Our work has been progressively successful as our numerical strength has grown, and its success has proved the greatest incentive to further expansion. More than any other body, the union has taught milk producers the value of collective action, and I am convinced that before very long the vast majority of producers will have been enrolled in our ranks. When that consummation has been achieved the industry will occupy a very much stronger position than it has previously done.

Chairman WILLITS. Is there any discussion? The time is limited to five minutes.

Mr. CLARK. I would like to inquire how the price that the consumer pays in England compares with the net price that the producer gets.

Mr. LANGFORD. Well, we in England, operating in behalf of the consumers, don't regard it as right to dictate, or attempt to dictate, the price of milk, retail. Our only consideration, and our only interest in retail prices, is that they shall be sufficiently low as to put a maximum quantity of milk into consumption. We, as producers, don't regard ourselves as having the necessary evidence upon which to make up our minds what spread, or margin of profit, the retailer should have for the services that he renders.

Mr. JOHN A. SCOLLARD. Did I understand you to say that there were but two main distributing agencies in the city of London?

Mr. LANGFORD. I was speaking of the history of the industry. There are more than two now. That is, with the wholesaler. The producer sells to the wholesaler, very largely, and the wholesaler sells in flat quantities just the required quantities to the retailers, and the retailer passes it to the consumer.

Mr. J. GILLARD STAPLETON (England). Mr. Langford mentioned in regard to the dispute between distributors and producers, that the surplus milk was withheld by the producers. I don't quite understand what he means by that.

Mr. LANGFORD. I was referring to what happened in the spring in 1922. As I indicated in my paper, the price offered by the trade to the producers was an extraordinarily low one, and in consequence it became my duty, as chairman of the National Farmers' Union milk committee, to summon to London a national conference representing the producers of the whole of England and Wales. Up to that point we had been met by the trade by this, that they could give us a better price for the milk if it were not for the vast amount of surplus milk that they were compelled to take. At the conference to which I refer, we indicated the position to the producers, and I put it to them that in order to get a fair price, a reasonable price for the milk which could be put into liquid consumption, and in order to enable the trade to pay that price, it was necessary to withhold the surplus milk. In other words, do as Mr. Manod Owen has indicated in his paper, use the surplus milk where it is most profitable to use it, that is, upon the farm.

At that time the milk, the new whole milk, was worth more for pig feeding, for calf raising, and for other purposes upon the farm than the price which the trade was offering; and we, as producers, did not desire to withhold from the public the milk that they wanted to consume. It was up to us to do the best we could in our own interests with our milk. If at any time the farm offers the best market for milk, I don't regard it out of place to keep that milk upon the farm. We, the producers, are not philanthropists, and that is what I put before them, and so successful was the advice that I gave to the farmers that these new prices operated on the 1st of April—perhaps a curious day. [Laughter.]

On the 3d of April, I believe I am right in saying, London was short of 13,170 gallons of milk, because the farmers had withheld the surplus. The trade had offered a low price. They certainly were going to retail it at a low price. The papers came out in the morning "Where is this cheap milk? It can't be found. The price is low, but the buyers can't get full satisfaction." It was at that point that the Minister of Agriculture intervened and called a conference, representing all interests in the milk industry, and tried to get us together. That conference was abortive. The next morning we were going to call a national strike in order to get a fair price for the milk. But the trade, having slept over the matter, came to a more sane decision, and the next morning offered us 2 pence, and in some instances, 2½ pence. They were also generous enough to say that the people from whom they had bought the milk on signed contracts, would be given the increased price as well as those who had not sold their milk. From that point forward we have been able to work hand in hand with the trade, and the feeling that exists to-day between the trade and the producers is upon such a basis that I have no fear, no misgivings, as to the future success of the industry in our country. [Applause.]

Chairman WILLITS. We have certainly appreciated this talk, Mr. Langford. The next paper is by Mr. Holman, on a "Review of progress in fluid-milk marketing in the United States."

REVIEW OF PROGRESS IN FLUID-MILK MARKETING IN THE UNITED STATES.

CHARLES W. HOLMAN, secretary, National Milk Producers' Federation, Washington, D. C.

THE PUBLIC AND THE MILKMAN.

No group of farmers has to wrestle with so unstable a public as do the milk farmers. Associated with the idea of milk is a keen resentment of any attempt to raise prices. This attitude of the public has been carefully fostered for some years by certain large metropolitan papers, and it is well illustrated by the ultimatum issued in 1917 by certain Chicago dailies, when a milk war was threatened, that no matter what it cost the farmers to produce the milk the retail price should not go above 12 cents a quart. The editors of such papers did not care, apparently, whether the conditions surrounding the production of milk in their respective districts would be favorable to maintaining an adequate and a constant supply. Such blind prejudicial efforts, of course, defeat themselves in the long run, for if a product does not bring to the farmer a return at least approximating wages there will be an inevitable curtailment in the volume of such product made available for the market, due to enforced retrenchment policies on the part of the producers.

Associated also with the public mind is the question of quality, and no other product is so carefully supervised, nor are so many restrictions placed around the original producers; all of which tends to increase the costs of getting milk upon the market. No other product has quite as complex a system of distribution, or one which requires a more highly geared system to carry it from producer to consumer. Enormous masses of capital are necessary, and from producer through distributor the trade is constantly under the necessity of making expensive improvements, largely with the maintenance of quality in view.

Overnight a city council may pass an ordinance, or a city health officer may issue an edict, which will require an expenditure of from $1,500 to $3,000 for each individual producer who supplies a city market. Overnight some prosecuting attorney, anxious to cater to the popular will, may announce in stentorian tones that he proposes "to investigate this producers' association." Sometimes those "investigations" have been inspired by persons financially interested in preventing the organization of the milk producers. Sometimes there have been simply demagogic demonstrations. But the cost to the producer can not be estimated in the enlarged volume of ill-will, prejudice, and misunderstanding. In nearly all of these cases the producers have won, but at fearful cost. In few instances their organizations, after winning their fights, have been so seriously shattered that they have cracked and gone to pieces.

In the face of such obstacles, cooperative milk producers of the United States have gained for themselves an enviable position. They have passed from the pioneer stage. They are becoming well established. And the extent to which they do become established marks the stage of tranquillity and stabilization in the milk trade of the region served.

It has been truly said that local cooperation and national organization have been the salvation of American dairy farmers. Local cooperation has taken long strides in solving the marketing problem. It has put unorganized milk producers on a parity with great milk-buying combinations. It has enabled them to help the consumer by cutting down the "spread of the distributor and sharing it with the consumer." It has tended to stabilize market conditions.

National organization has enabled these local associations to win important battles involving congressional action and decisions of governmental departments.

BEGINNING OF COOPERATIVE MILK MARKETING.

Fifty-one years ago the first notable effort for farmers to market their milk collectively was made in New England. It was just a crude, unincorporated association formed to make price agreements with the dealers. It continued actively for about 10 years. In the decade beginning with 1871 there were numerous efforts around the metropolitan centers to form collective bargaining associations, but of all these efforts the Boston organization was perhaps the most effective. The picture of milk marketing for the 40 years following this first organization is the kaleidoscopic view of the formation and dissolution of association attempts. The movement was gaining popularity, but there was neither the technique nor the legal basis developed at that time which would permit permanent institutions to be formed. Only the capital-stock corporation was in existence, and although there were numerous efforts made to utilize this type of corporation—owing to the fact that the capital stock corporation is organized around the dollar instead of the man, and it exists for profit rather than for service—most of the farmers' capital-stock corporations formed during this period tended to get into the hands of a limited number of individuals and became simply additional middlemen institutions.

THE LEGAL BASIS OF COOPERATION.

It was not until 1909 that cooperation had its legal birth in the United States. In that year the State of California passed a cooperative act providing for the formation of nonstock, nonprofit membership corporations. Two years later the State of Wisconsin enacted a cooperative law under which associations of the Rochdale type could be formed. This act was drawn by the late Dr. Charles McCarthy, of the Wisconsin Legislative Reference Library, with the assistance of Sir Horace Plunkett, the father of Irish cooperation and internationally known for his lifelong service in the building of agricultural cooperative institutions. Very rapidly thereafter the various States enacted cooperative laws, some using the Wisconsin act as a model, others the California act. Very valuable service was given the idea of standardization of cooperative laws by the early efforts of the United States Bureau of Markets, the National Agricultural Organization Society, which functioned for the years 1915 to 1917 as a service agency to promote the advancement of cooperation, and by the later efforts of Aaron Sapiro, who drafted a standardized cooperative act which passed the legislatures of 26 States. Most of the States to-day provide for the formation of both the nonstock, nonprofit type of cooperative corporation and the Rochdale capital-stock type. Both of these types of cooperatives are useful, and there are conditions where it would be better to form one than the other. In the dairy world both types are to be found. The New England dairy movement and most of the local cooperative creameries and cheese factories are of the Rochdale type. In New England, two or three systems are being builded of the Rochdale type. But most of the flourishing fluid-milk organizations belong to the nonprofit, nonstock membership cooperation type.

IMPULSES TO MODERN MARKETING METHODS.

Cooperative milk marketing in the modern sense began about 10 years ago when the New England Milk Producers' Association and the Dairymen's League got well under way. The greatest impetus, however, was given cooperative organization in 1916. The reason is fairly obvious. Producers supplying the great cities were relatively impotent in their dealings with the distributors. The prices which farmers were receiving for their milk were very low as compared with their costs of producing it. The margin, or spread, taken by the dealers for distributing milk, was out of all proportion to the service rendered. This worked an injustice both upon the producer and the consumer.

By this time outstanding leaders had been developed among the milk producers, the legal basis of cooperation was well established, and economic pressure furnished an incentive to organization.

The entry of the United States into the World War further hastened the progress of cooperative milk marketing. The Government, through the Food Administration, established a chain of milk tribunals or commissions to determine prices the producers should receive. The very process of making an appearance before these tribunals necessitated organizations, and by the end of the war cooperative milk marketing was well established around the principal cities of the United States.

THE STRUGGLE FOR RECOGNITION.

The late Hon. Milo D. Campbell, who for six years was president of the National Milk Producers' Federation, often referred to the organized milk men as the " Rainbow Division of Agriculture." This phrase was very apt, for perhaps no other group of farmers has suffered so and has been so forced to fight its way through to solidarity. This, of course, is due to the perishability of the product and to the pitiable plight of the unorganized producers.

It may be well to cite a few of these struggles.

In 1916 dairymen of both Boston and New York districts were forced to withhold their milk from distributors supplying those cities, pending failure to reach a price agreement. These associations were comparatively weak at the time the milk wars began, but within a few months the stimulus given the associations by the fight added many thousand to their membership. A like condition prevailed in Cincinnati, where a few hundred farmers were forced into a milk war in order to obtain recognition of their right to deal collectively. For 40 days they withheld their milk from the city of Cincinnati. During the progress of the war, the membership in the Cincinnati association increased to nearly 2,000.

In 1917 a difference of opinion between members of the Milk Producers' Association of the Chicago district and the distributors resulted in a war which brought the interposition of the Food Administration and was only settled by that agency. Negotiations between the agents of the farmers and the Food Administration resulted in these representatives of the farmers going back and calling a meeting to try to put into effect the recommendations of the Food Administration. Immediately the State's attorney of Cook County, Ill., claimed that this meeting was a violation of the State antitrust act and filed suit to criminally prosecute the leaders of the association, eight directors being indicted.

Arrangements were made for the prosecution to be delayed during the term of the war, but in 1919 the State's attorney resumed the prosecution and a jury trial was held. These jurors were all city men, and most of them were laboring men and consumers of milk. Their verdict was "not guilty," but the trial cost the farmers of that district approximately $65,000 and greatly disturbed the morale of the organization.

In the same summer the directors of the Ohio Farmers' Cooperative Milk Co., supplying milk to the city of Cleveland, were suddenly arrested in the dead of night under charge of violating the so-called Valentine Antitrust Act of the State of Ohio. These men were dragged to the county jail of Cuyahoga County and thrown into a vermin-infested cell, which they were required to share with one person who was an idiot and another who was undeniably a degenerate. They were denied their constitutional right of bail until 10 o'clock the next morning, when their friends obtained their release. This trial also resulted in a verdict of "not guilty."

Attempts at prosecution have been made in other States and attempts to invoke the Federal statutes have also been made. For example, in New Orleans, where a group of dairy farmers, one or two hundred in number, had a difference of opinion with the principal dealer of that city over a question involving a reduction in the price of milk and the proportionate share which the dealer and the farmers should take in the price cut, the members met to consider the situation, and the Federal district attorney started a prosecution against them. It required assistance from other associations to help these men in their struggle with their prosecutors, but that indictment was quashed. There is hardly an association to-day, a member of our federation, which at some time or another has not had to face so-called prosecutions which were in reality persecutions.

This condition of affairs greatly disturbed the stability of the milk industry and led to the movement to secure a certain degree of amenity from the operations of the Federal antitrust act. Milk producers' associations were particularly concerned, since few of them were formed within State lines, their structures being interstate and conforming to the regional milk supply of the great cities of the country, and most of the great cities of the country are so situated that they draw from parts of several States. This movement and its results will be described later in this paper.

TYPES AND CLASSES OF MILK MARKETING ASSOCIATIONS.

Here is a rough classification of the various cooperative farmer-owned milk marketing associations:

(*a*) Collective bargaining with the check off by dealers of association charges.

(*b*) Collective bargaining supported by membership dues without check off.

(*c*) Collective bargaining where associations own surplus plants and operate with or without check off.

(*d*) Collective bargaining associations to which are affiliated manufacturing cooperatives who purchase their milk just as other manufacturers, dealers, and distributors do, but whose membership is almost identical with that of the collective bargaining association.

(*e*) Cooperative wholesaling of milk, with ownership of country plants and receiving stations in cities.

(*f*) Cooperative pooling organizations with which is combined extended ownership of country plants and wholesaling operations in cities, together with distributive arrangements for manufactured milk products.

(*g*) Cooperative wholesaling and part-retailing pooling associations.

(*h*) Cooperative retailing, city distributive associations owned by the farmers.

The above classes are all in existence to-day, but no single association can be said at the present time either to have achieved its full measure of development or to be in a static or permanent form. They are all constantly changing, constantly making adaptations, constantly evolving from one state to another. The ordinary course of evolution is this:

The association begins in a community as a collective bargaining organization. Sometimes it is incorporated; sometimes it is not. Always, in time, it becomes incorporated. If it succeeds and incorporates as a cooperative, its first efforts are to change the system of purchasing milk, to which the dealers are accustomed, from a relationship between the distributor and the individual farmer to one involving recognition of the association, with an association price committee to make the price for all of the farmers in the district who are members of the association.

Usually the farmers in their demands for recognition incorporate a request that the dealers deduct from the milk checks of their members the association's commission for serving as the collective bargaining agency. Sometimes the dealers are friendly to this and sometimes they are not. If they are not friendly and the association is weak, it becomes necessary for it to collect its own dues, which is a very expensive process. Sometimes it prefers, even at this expense, however, to collect its dues in order to maintain more complete independence and a larger measure of power in negotiating for price.

The next step is to get the dealers to consent to having representatives of the association check up the weights and tests of the milk sent in by member shippers. The third state comes when joint efforts of farmers and dealers to solve the problem of disposition of surplus milk brings about a move on the part of the farmers to take care of their surplus through the erection of one or two plants. Sometimes these plants are especially incorporated, and when that is the case we may find a dual system of associations operating in a territory. Under these conditions the collective bargaining association frequently finds itself in the position of building up a new organization which in time will replace it.

The operation of a surplus plant is rarely a successful financial enterprise in itself, and its measure of service must be the price which it realizes for the members on their surplus milk rather than whether it can pay its own expenses. But where the plant does not pay its own expenses and still must be maintained, the association then faces a very definite problem as to whether the revenue from the fixed brokerage will be sufficient to maintain the organization and pay for the running expenses of the plant.

In some districts this problem leads at once to the thought that the farmers whose milk is cut off and who must patronize the surplus plants have a right to a higher price for their milk than they can get through its disposal as cream or butter or cheese, as the case may be. It also brings up the point that the keeping of the surplus away from the fluid-milk market may mean an extra sacrifice for some men and no sacrifice for others. That leads to the feeling that there is no God-given privilege to any one set of men to have access to the highest price of milk, and that those who live in regions of cheaper milk supply and may be in a position to ship their milk into the city are performing a common and useful service by shipping their milk to the manufacturers. Hence, we have the evolution of the thought that every milk producer within a given area who belongs to the association should receive the same price for his milk, provided it is of like quality, butterfat percentage, etc., as every other producer subject to these and other equitable differentials. That is the pooling idea and that is what pooling means.

Already in a number of communities we have this pooling idea in operation in varying forms. It extends all the way from the operation by the farmers' association of a pool among dealers so as to equalize their conditions and bring to the farmer this uniform price of milk, to its most perfected form where the association sells all of the milk and collects for all of it, does its own accounting work, and distributes the checks for milk among its members after making all of the necessary deductions.

Just as the forms of the associations differ, so do their functions, and the constituent members of the National Milk Producers' Federation contain every one of the above-listed forms.

According to official figures based upon voluntary reports, there are to-day in the United States at least 41 cities where farmers are delivering milk to the housewives' doors from modern milk plants owned by their associations. Thirty-nine of these associations sell milk for 11,281 farmers. Thirty-six of these associations do an annual business amounting to $12,393,934. Twenty-seven sell an average of 59,820 gallons daily, used by 81,139 customers. There are communities where efforts of this kind have a chance to succeed. There are other communities where such efforts would be doomed to failure; and producers should consider very carefully the real measure of gain which they can make before undertaking such attempts. The modern milk business is so complicated that it requires large outlays of capital and the most highly trained, technical staffs and the most competent executive ability.

Thirty-one wholesale milk marketing associations have reported a membership of 101,620 milk producers. Twenty-five of these associations in 1922 reported a combined turnover of $103,023,715. In addition, the Department of Agriculture has had reports from 20 collective bargaining associations with a combined membership of 80,325 farmers. It is impossible to estimate accurately, or even vaguely, the value and volume of milk and cream sold by the collective bargaining associations. In addition to the price received by the members, the nonmembers everywhere get this same price as a rule. So the organized farmer carries, as usual, the burden for the unorganized farmer.

In the wholesaling and manufacturing of milk products dairy farmers have made rapid strides. A number of associations have now gotten into the big-business class. Among the notable ones is the Dairymen's League Cooperative Association (Inc.), of New York. This organization is the greatest single dairy farmers' cooperative association in all the world. It has its own brand. It distributes nationally and internationally, and has an annual turnover of nearly $90,000,000.

The league employs nearly 3,000 persons and spends about $600,000 annually to advertise its products under the name of "Dairylea." It is one of the largest manufacturers of condensed and evaporated milk products in the United States. It has agencies in foreign countries and is rapidly expanding its markets. The league operates its plants through a central management. Its structure embraces nearly 1,000 local incorporated leagues divided into 24 districts. A director of the parent association for each district is elected by ballot of the individual milk producers who comprise the membership. Although it has 72,000 pooling contract signers, the league reserves the privilege of taking into the pool the signers only as fast as it can handle their products; but it makes arrangement for the satisfactory handling of the members' products pending admission to the pool. At present about 55,000 persons are active poolers on a perpetual contract which, however, allows the signer the privilege of withdrawing during a stated period of each year.

Another notable cooperative association is the United Dairy Association of Washington, with headquarters at Seattle. This association controls a number of manufacturing plants and disposes of products annually amounting to about $10,000,000. It has its own brand, "Darigold," which is nationally known. A third large association is the Turner-Centre System with headquarters at Auburn, Me. This system operates over New England and is in the process of being purchased from its original owners by the milk producers. The new plan provides for a New England-wide system. The Rochdale type of association is used for this reorganization. The annual turnover of the system amounts to about $4,182,000. Its members are practically all members of the New England Milk Producers' Association, which is the collective bargaining organization of the farmers in that part of the country. The association is also promoting another system to furnish milk to the cities in western New England. This system is identical in structure with that adopted for the Turner-Centre System except that the ownership of the locals is on a local basis, but the plants are to be managed by a central service organization whose directorate is composed of representatives of the local plants and one representative of the New England Milk Producers' Association.

ORIGIN AND PROGRESS OF NATIONAL ORGANIZATION.

It was about the time of the famous 1916 milk strikes that leaders of the milk producers throughout the country realized there should be some common instrument for common action in matters that affect them nationally, and there should be a service agency created to provide them with the information necessary to more successfully control their bargaining with the distributors.

In the fall of 1916 the writer proposed to the leaders of the Chicago Milk Producers' Association that a national conference on the marketing of milk be made a section of the National Conference on Marketing and Farm Credits which was to be held in Chicago that winter. This proposal was accepted, calls were issued, and 700 dairymen from various parts of the United States attended the sectional meeting and authorized the formation of a national committee to set up a national federation. This committee agreed upon a set of by-laws and formed a provisional federation which was incorporated under the laws of Illinois in February of 1917. Like most movements, the original organization committee consisted of some persons actually representative of milk producers' associations and some who were not. In time the directorate was changed until the federation became exclusively an organization controlled by representatives from the member associations. It is not a trading organization. It is a protective and service body.

In the first year or two of its existence it numbered 10 or 12 associations. To-day it numbers 27 regional marketing associations and one State federation of cooperative creameries comprising about 250 local creameries. The federation has under consideration the enlargement of its scope so as to make it the representative body for all of the cooperative dairymen in the United States.

During the war this federation confined itself to representation before the governmental bodies with a view to having fair play for its membership. In 1920 it established Washington headquarters and inaugurated a price-information service. In the same year it proposed to the National Board of Farm Organizations, of which it was a constituent member, the introduction into Congress of a bill whose purpose would be to secure for bona fide cooperative associations a certain degree of exemption from Federal prosecution. This bill was known as the Capper-Hersman bill. Our present president, John D. Miller, was one of its authors.

After some months of fruitless effort, the federation accepted a modified bill drawn up by Representative Volstead and later introduced into the Senate by Senator Capper, which became known as the Capper-Volstead bill. The purpose of this bill was to authorize cooperative associations, corporate or otherwise, to form and do business in interstate commerce. This bill provided that cooperative associations subject to the act should come under the jurisdiction of the Secretary of Agriculture, and thus removed, in major part, many difficulties of our regional associations arising from prosecutions initiated by Federal district attorneys.

This bill passed the Lower House twice in succeeding Congresses before it was finally enacted by the Senate and signed by President Harding. It has been declared to be the cooperators' bill of rights, and constituted, undoubtedly, the outstanding agricultural achievement of the Sixty-seventh Congress. It had been indorsed by both parties prior to its passage, and the vote upon it was a nonparty vote.

Through the efforts of the National Milk Producers' Federation, millions of dollars have been saved annually to the dairymen of the country by the inclusion of moderate protection in the tariff act of 1922. The National Milk Producers' Federation stood unqualifiedly for protective duties on all of the dairy products and on the major vegetable oils which come into competition with American-produced oils and fats.

There was a general disposition in both Houses to give the dairy interests reasonable protection, in regard to butter, cheese, and tinned products, but there was some hesitancy over protecting whole milk and cream, and a stiff fight was put to keep casein on the free list. For a time, it was quite doubtful as to whether these last three items would be given the protection they needed. The manufacturers of coated paper, who were interested in obtaining casein as cheaply as possible, did all in their power to prevent the levying of a protective duty on this product. But, by diligent effort of the National Milk Producers' Federation and other bodies cooperating with it, this fight was won. Likewise, we won, in a spectacular battle, most of our contentions as to vegetable oils.

A comparison of butter prices in Canada and in the United States shows that the dairy tariff is worth at least 8 cents a pound to the American producer. There are 1,500,000,000 pounds of butter produced in the United States, and this would mean an annual saving to the American dairymen of $120,000,000.

America has passed out of the stage of cheap farm land and cheap farm labor. Newer countries are entering dairying and are becoming important factors in the international trade situation. These countries are able to ship their products into the United States at such prices as would bankrupt American farmers if they had to compete. For that reason the gospel of a protective tariff has been generally adhered to as a matter of policy. Milk has reached the point in its balance of trade and dairy products when consumption almost equals production. Three years ago our net exports of combined dairy products were 2,600,000,000 pounds. In 1922 our combined exports were less than 100,000,000 pounds. It is clear that the domestic market is to be our great market of the future, and American cooperatives should shape their program to meet this condition.

Perhaps the most bitterly contested fight was that with the makers of filled milk over a bill introduced by Representative Voigt, of Wisconsin, to prohibit the movement in interstate and foreign commerce of this imitation product. Filled milk is made by extracting the butterfat from the whole milk and replacing it by some vegetable oil, principally cocoanut, and evaporating the resulting emulsion. The process turns out something that looks, tastes, and smells like pure, evaporated milk, but which does not have the growth-producing elements in it that whole milk contains. This fight required almost two years, but finally resulted in an overwhelming vote of both Houses of Congress to ban the product; and filled-milk making to-day is practically a dead industry But the federation proposes to continue this fight until every State in the Union has an antifilled-milk statute. To-day about 20 States have enacted laws to prohibit the manufacture and sale of filled milk.

The tariff fights on casein and vegetable oils are not over. Opponents of protective duties have taken these cases before the United States Tariff Commission, and the federation has assumed the burden of protecting American agriculture by appearances and arguments before this body, which, under the flexible tariff provision, has certain powers of investigation and recommendation with regard to changes in duties.

It is beyond the scope of this paper to enumerate all of the national activities of the cooperative milk marketing associations through their national federations. Such activities include representation of various kinds before Federal departments and commissions on a variety of questions, ranging from income-tax regulations to freight-rate reductions, statistical and economic services for member associations; organization efforts in the field, reorganization services to members who are planning changes in their structure and methods of operation, and the maintenance of friendly contacts with other groups.

FEDERATION'S ENLARGEMENT PROGRAM.

During the seven years of its life, the federation has quietly, but consistently, enlarged its activities. During that same time its constituent units have steadily enlarged the scope of operations so that to-day the interests of many of its members are identical with the interests of the butter and cheese cooperatives. Consequently, it has been determined to enlarge the scope of the federation to include all cooperative dairy marketing organizations whose interests might be served by affiliation. Within the past year, one State association, representing 250 local cooperative creameries, has been admitted to membership. It now represents about 250,000 milk producers from coast to coast who sell their milk and its products through the member associations.

The officers of the federation are: John D. Miller, president; W. F. Schilling, first vice president; H. W. Ingersoll, second vice president; F. P. Willits, treasurer; Charles W. Holman, secretary.

The directors are: John D. Miller, Susquehanna, Pa.; H. W. Ingersoll, Elyria, Ohio; W. A. Carrier, Strawberry Point, Iowa; C. R. Rice, Milwaukee, Wis.; W. F. Schilling, Northfield, Minn.; H. W. Tinkham, Warren, R. I.; A. C. Stoxon, Bassett, Wis.; F. P. Willits, Ward, Pa.; Jno. C. Near, Flat Rock, Mich.; Harry Hartke, Covington, Ky.; J. M. Henderson, Sacramento, Calif.; P. S. Brenneman, Jefferson, Ohio; Richard Pattee, Newton Highlands, Mass.; J. A. Scollard, Chehalis, Wash.; J. G. Thompson, Landover, Md.; P. T. Holt, Kenosha, Wis.; H. J. Schultz, Shipman, Ill.; D. G. Harry, Pylesville, Md.; A. O. McMakin, Shelbyville, Ky.; R. D. Cooper, Little Falls, N. Y.

The organizations affiliated with the National Milk Producers' Federation are: Dairymen's League Cooperative Association, Inc., of New York City; New England Milk Producers' Association, of Boston; Connecticut Milk Producers' Association, of Hartford; Interstate Milk Producers' Association, of Philadelphia; Maryland State Dairymen's Association, of Baltimore; Maryland and Virginia Milk Producers' Association, of Washington, D. C.; Dairymen's

Cooperative Sales Co., of Pittsburgh; Ohio Farmers' Cooperative Milk Association, of Cleveland; Summit County and Vicinity Milk Producers' Association, of Akron, Ohio; Northwestern Cooperative Sales Co., of Wauseon, Ohio; Michigan Milk Producers' Association, of Benton Harbor, Mich.; Cooperative Pure Milk Association, of Cincinnati, Ohio; Kentucky & Indiana Dairies Co., of Louisville, Ky.; Louisiana-Mississippi Dairymen's Cooperative Association, of New Orleans; St. Joseph Milk Producers' Association, of St. Joseph, Mo.; Southern Illinois Milk Producers' Association, of East St. Louis, Ill.; Milk Producers' Association of Chicago; Milk Producers' Marketing Co., of Chicago; Milwaukee Milk Producers' Association; Twin Ports Dairy Association, of Superior, Wis.; Iowa Cooperative Creamery Secretaries' and Managers' Association, of Waterloo, Iowa; Des Moines Cooperative Dairy Marketing Association; United Dairy Association of Washington, Seattle; East Tennessee Milk Producers' Association; the Farmers' Milk Producers' Association, Richmond, Va.; and the Associated Dairymen of California.

FUTURE DEVELOPMENT OF COOPERATIVE MILK MARKETING.

What will the future bring to the milk industry? It is clear to me that the larger the city the more difficult it is for farmers to own their own distributing systems for retail consumption of milk. But there are a number of small cities and even large cities throughout the country where there seems little doubt but cooperative associations will gain a foothold and either develop to where they become farmer monopolies supplying the cities, or they will utilize the maintenance of a number of routes as a basis of better bargaining arrangements with the private distributors. In some cities, cooperative consumer associations will be found as already exist in Minneapolis, where the Franklin Cooperative Creamery is a very potent factor in the milk situation of that city. There are some advantages to farmers maintaining direct-to-consumer milk operations. Among them are:

1. A reduction in the total number of routes now maintained for competition.
2. Elimination of milk wars.
3. Reduction of margins taken for milk distributions.

Among the disadvantages are:

1. Difficulty of securing competent technical help.
2. The opportunity afforded demagogues to make capital out of the so-called farmer monopolies.

There is no one between the farmer and the consumer where farmers maintain their own distributive systems, and the whole blame of the price of milk must necessarily fall upon the cooperative associations.

But, whatever may be the outcome, there is no doubt that we are moving toward a more satisfactory condition in the distribution of milk. There is a tendency toward stabilization. Dealers' spreads are being cut, and in many communities a satisfactory margin has been found on which dealers can live and do real service. Instead of the disastrous milk wars of the past, we may find, with a complete recognition of cooperative marketing, that both distributors and the farmers through their associations will discover many things which they can do together to improve the milk supply, to cut costs and to increase consumption. Of one thing, at least, we may be sure: Cooperative marketing of milk is in this country to stay and the cooperative movement is growing stronger year by year.

Chairman WILLITS. Is there any discussion?

I have now the honor of introducing to you Mr. Richard Pattee, who will speak on "Types of collective bargaining organizations."

TYPES OF COLLECTIVE BARGAINING ORGANIZATIONS.

RICHARD PATTEE, managing director, New England Milk Producers' Association, Boston, Mass.

Cooperation as now practiced in the sale of dairy products in America has progressed from crude beginnings through various stages of development; nearly every cooperative unit started at the same point and has advanced along the same road. All along that road, from the primitive beginning to the most complete and complex operation, there are now units in successful operation, examples of the steps by which the most advanced progress has been made.

This development is divided in a general way into two stages: First, the bargaining; second, the operating—each of which in turn is divided into lesser periods of progress.

This paper has to do with the subdivisions or lesser stages into which the bargaining period of development is divided.

First, let us define our terms. For my purpose, I will define a bargaining organization as a group of producers associated for the purpose of jointly negotiating the sale of their products upon common prices and terms. In this type of organization there is no merger of title in, no transfer of possession to, or distribution of return by the common agency or association. The bargaining organization is a means through which individuals, who continue to do business as individuals, may decide upon and carry out plans upon which the group has agreed. It is the machinery for determining the common will and judgment with respect to prices and conditions in the sale of their individual products.

Such organizations usually pass through certain clearly defined stages, which ultimately lead to the second major division, namely, the operating organization in which titles may be merged in, possession may be transferred to, and distributon of returns may be made by the producers' organization. These stages are exemplified by certain structural types of organization and processes of operation.

First type. The voluntary association for conference, recommendation, and negotiation. Such organizations are usually composed of producers, selling in a common market, who get together to discuss conditions and agree upon courses of action. Their effectiveness depends upon the willingness of the individuals to carry out in their private operations the plans and policies recommended and agreed to in the group conference. Such associations are based upon the faith in each member that the others will adhere to the course determined upon for all. Disciplinary power lies only in the moral obligation upon each to adhere to the program agreed to for all. There is no legal obligation or restraint. The machinery of organization is usually only such as will enable the meetings of the group to be called and conducted in an orderly way, suitable records to be kept, and finances sufficient to meet expenses raised, spent, and accounted for.

When such voluntary associations function in large markets, supplied by producers widely scattered and remote from each other, the form usually provides for special committees or groups of officers to act for the whole in dealing with emergency problems that may arise between regular meetings. The cost of maintenance is usually met by assessments, graduated according to volume of business. Usually such associations have special committees of officers to confer and negotiate with the buyers, study market conditions, and recommend courses of action. These associations usually serve well, for a time, the purpose for which they were organized. They usually fail in the end for one or another of the following reasons:

1. Lack of loyalty and adherence by individual members, to policies and plans.
2. Lack of financial support.
3. Jealousy of leadership and factional division.

Second type.—The voluntary unincorporated association is usually followed by the nonstock, nonprofit membership corporation. This form of organization usually undertakes a more formal program than the voluntary association, but generally it is upon the same lines. Its incorporation relieves its members of individual financial liability and provides a more responsible form of procedure and leadership. It usually looks forward to a still more formal and definite business relationship than it at first undertakes. Usually it provides a paid staff and sets up contract relations between itself and its members. These relations usually pertain to the rights and obligations of membership, designed more to remedy the faults of its voluntary predecessor than to confer powers and duties with respect to the products of its members. The first thought in setting up a corporation to follow a voluntary association, is to correct the internal faults of the latter, not to materially change or alter its functions, but to perform them in a more efficient manner. It often provides penalties for violation of its rules and generally it affords a legal entity through which the will of its members may be determined by mass action accompanied by a presumably binding obligation upon such members, to be guided in their individual operations by the will of the group, as ascertained and determined by and through the machinery of an incorporated organization in which all are members and have an equal voice. Such corporations are almost always organized upon the one-man, one-vote plan. They do not alter or interfere with the private and individual operations of the member, except that the member agrees that in his operations he will be guided by rules, regulations, and processes determined upon by the group, for the common welfare. The difficulties of such an organization lie largely in the weakness of its contract relations with its members and the lack of adequate and enforceable penalties. Such corporations provide a way in which individuals may collectively determine how business should be done by all, and while each member does his own business for himself, he contracts with the organization to do it in a certain way. The faults of this arrangement are similar to those of its predecessor, the voluntary association, and usually lead to its reorganization, either structurally or in methods of operation, into the next class of bargaining organization.

Third type.—The agency corporation. In legal form little difference appears between this and the preceding type, except a broadening of powers, more definite and binding relationships, and better provisions for support and service. Here appears the more binding contract, the more drastic penalty, and the definite period. Now the individual surrenders to the group not only the determination of what shall be done, but creates the group his agent to do it, so far as his products are concerned. The organization has now not only the function of determining what should be done, but the mandate to do that thing for each of its members. To enable it to do its job, it is empowered by the member to act in his stead, and in his behalf to do the things he would otherwise bind himself to do with respect to his products. The corporation now takes upon itself the duty of carrying out the plans and policies it formerly recommended to its members. This operation is usually based upon a valid, binding contract of agency, by which the member authorizes the organization to act for him, agrees to be bound by its acts, and to pay a stipulated sum for its services. This form of organization has such powers and control over the products of its members that it commands the attention of buyers and is able to set up and maintain trade practices and policies within reasonable limitations. It can not, as a matter of practice, make prices. It can simply assess and enforce values according to the law of supply and demand. Without facilities for manufacture and storage, it must move the products of its members upon the best terms obtainable. Its great advantage lies in such control of the product as shall make prices and practices uniform and regular, as between its members. It can not regulate the flow of products, but it can and does keep order among the producers so that all may share alike in the common benefit, or burden. The bargaining organization which has reached the agency stage of development inevitably looks forward to the ownership of facilities whereby it may deflect, deter, or accelerate the flow of products to its markets, according to the demands of consumers. This means capitalization, operating organization, and a system of salesmanship possible only in another type of development, for which others are here to speak.

Chairman Willits. Are there any questions? I know that Mr. Pattee is in a position to answer any questions along this organization line. He has been on the job for some years.

The next paper will be " The Dairymen's League," by Judge J. D. Miller.

THE DAIRYMEN'S LEAGUE.

J. D. Miller, president, National Milk Producers' Federation; vice president and general counsel, Dairymen's League Cooperative Association, New York City.

Mr. Chairman, ladies, and gentlemen: As the time of this meeting is limited, I will abbreviate, touching only on some of the high spots.

Some of you may be interested, first, as to the form of organization of the Dairymen's League Cooperative Association. It is an association that has passed through several stages of development, somewhat similar to those described by Mr. Pattee in his excellent address, and has now reached a stage where it is an operating organization, owning, controlling, and operating more than 100 receiving and manufacturing plants in the country, with distributing plants for wholesale distribution in some of the cities. In form it is a nonstock corporation. It has no capital stock. The association makes no profit; but after deducting expenses, distributes the proceeds of all sales, in due course, to members. It does not buy and sell milk, but functions as a selling agent for members.

As the gentleman from Wales stated, one after another, the fundamental principles of cooperative marketing, it is interesting to note that each one of the principles he enumerated is among the basic principles of the Dairymen's League. The relation of the farmers to the association is a threefold one:

First. As members, whereby they control the association by electing directors.

Second. As principals, employing the association as a selling agent, and

Third. As creditors, lending the association funds to capitalize it.

Each of these will be briefly discussed in the order stated.

First, control. The Dairymen's League Cooperative Association is built from the ground up. Its control is for all time vested in its members. One of the problems of those who were active in forming the organization (and there were many assisting in this) was to devise a system of control that would prevent any directorate or management from becoming self-perpetuating. This was somewhat difficult by reason of the fact that the membership is so widely dispersed throughout a territory nearly 500 miles long and wide, being the milk-producing territory tributary to the metropolitan market and up-State cities in New York and the cities in northern New Jersey and northern Pennsylvania.

The method of control is as follows: There are 24 directors, and the territory is divided into 24 districts, each district having as nearly the same number of members as is possible without dividing counties. Each member is also a member of a subordinate league located near his home. Each year, in the month of June, there is a membership meeting consisting of one delegate from each subordinate league, of which there are 955. Several weeks before such annual membership meeting, in each district from which a director is to be elected, a district meeting is held consisting of a delegate from each local league. At such meeting, a nomination for director is made. To be eligible as a director, the nominee must be a member of a local as well as of the central association and must be a milk producer, marketing his milk through the association. The officers of each of these district meetings then certify to the office of the parent association, the name of the persons thus nominated. The secretary of the league then prepares an official ballot containing only the names of persons thus nominated, but with blank spaces for the insertion of other names. On a given day, a meeting of each local league throughout the territory is held, an election board is appointed, and members deposit their ballots. When all have voted, the ballots are counted, and the election board certifies the result to the head office of the league, inclosing therewith all of the ballots cast. These returns are made in special and sealed envelopes and are opened by an election board of the parent association, who compares the returns of the local election officers with the ballots cast, tabulating the result, and reporting the same to the annual membership meeting a few days later, at which time the candidates receiving a majority of all the votes cast are declared elected.

Directors hold office for three years, and in order to insure continuity of the management the term of office of eight of these expires yearly.

From what has been stated, it will be seen that no name can be placed upon the official ballot except the name of the person nominated by the members residing in his district, who are personally acquainted with his qualifications for the office. With such nominations made, all of the members throughout the entire territory vote at the final election, and it is worthy of note that persons thus nominated have always been elected by the membership.

No voting by proxy is permitted. The association recognizes the evils of voting by proxies in cooperative associations and in lieu thereof has made it easy and convenient for every member to cast his own ballot in his own local league.

Immediately after the annual membership meeting and the election of directors, the new board of directors meets for organization and then elects officers. The president and vice president must be members of the board of directors. The secretary and treasurer may or may not be directors.

The second relationship mentioned is that of principal and agent, which is a contract relation and is created by uniform contracts signed by each member and popularly known as the "pooling contract."

The contract gives the association very broad powers. By it the association is authorized to sell the milk produced by the members, or at its discretion to manufacture it and sell such manufactured products; to collect the proceeds of all sales and to blend such proceeds into one common fund, making distribution thereof to members, so that each member receives a uniform price per unit, subject to such equitable differentials as the association may from time to time determine. The principal differentials applied are location and quality differentials. Quality differential takes into consideration the percentage of butterfat in the milk and, in some instances, the bacterial count. Location differentials recognize the basic economic law that proximity to and remoteness from market should be given due consideration.

The third relationship is that of creditor and debtor. Members of the league recognize that if they are to efficiently market their products, their selling agent must be adequately financed. Therefore the pooling contract authorizes the association, in making distribution of the proceeds of sales, to withhold such uniform sums as the association may from time to time deem necessary to capitalize it.

This particular provision was, in the beginning, vigorously assailed by enemies of the movement, but it has been found that the members have used due care in the selection of directors to execute this power in that during no month since the association commenced operation has such deduction exceeded 20 cents per 100 pounds of milk, while the minimum deductions have been as low as 10 cents per 100 pounds.

It is worthy of note that, in practice, the existence of this unlimited power makes it unnecessary for the association at times to deduct as much for this purpose as if a limitation in the amount thereof were fixed in the contract. With such a limitation, the association, knowing the aggregate amount of certificates of indebtedness that mature at the end of the fiscal year, would, as a necessary precaution, make large deductions in the beginning of the year in order that no unforeseen contingencies would prevent its accumulating a sufficient sum to meet the year's maturities.

After the end of each fiscal year, each member receives a certificate of indebtedness for the aggregate amount that he has through the year thus loaned the association. The contract permits the association to cause such certificates to be payable at such time or times and bearing such a rate of interest as the association may from time to time determine.

This provision permits the association to so adjust annual maturities of certificates that no unduly large or unduly small sums mature in any one year. It also permits the association to name such a rate of interest as may fairly compare with the current market rate of interest. Funds for the payment of such certificates are provided in the same method by like deductions, thus creating a revolving fund. A farmer ceasing to be a milk producer ceases to be a member of the organization, and thereafter has no voice in its control, while the certificates issued to him remain unimpaired for payment at maturity.

The manner of distributing the proceeds of sales will now be stated.

Distribution to members is made monthly, the association first deducting its expenses. On or before the 25th day of each month, each member receives a check as an advance payment for the milk delivered by him during the preceding month. The association does not distribute monthly all the proceeds of sales, but only the approximate amount due, using care that no overpayments are made. The books of the association are closed once a year; and as soon after the close of each fiscal year as the business of that year is closed, each member receives a thirteenth check, the final check in full for the milk delivered by him during such year. The association mails all checks directly to members, with vouchers showing the quantity of milk delivered during the month by the member, its butterfat test, the differentials applied, the expenses, and the amount deducted as loans for capital purposes. With each check is sent a statement showing the approximate result of the month's operation.

The association is not large because it preferred to be, but because it was necessary in order to efficiently operate in its territory. Its gross sales for the last fiscal year ending with March, were between eighty-one and eighty-two million dollars. Up to the last report, the gross sales for this fiscal year exceed those for the same months of the last year by nearly one and three-quarter million dollars. If the same proportionate increase continues throughout the year, its gross sales will approximate something like ninety million dollars for the present fiscal year.

Before I conclude, may I take a moment to explain why the pooling organization was necessary. It is a reorganization of the old Dairymen's League created by the old league to be its successor. The old league was a mere bargaining association. It negotiated prices with buyers; and with prices determined, members delivered milk directly to the buyer, receiving payment directly from the buyer. This made it necessary to sell all milk at the same price regardless of the uses to which it was put; otherwise there would have been discrimination against some of the members. The problem thus presented had so many factors as to be a most vexatious one, as will be readily seen if I can paint a picture of conditions as they then existed.

Here was a large territory in which the cost of producing milk by reason of climatic and other material causes was very high. The costs of production for all milk entering cities were increased by the rules of the boards of health of cities in which the milk was marketed. No complaint is made of these requirements. They are, as a whole, necessary and have resulted in supplying the people of the city of New York with the best milk of any great city in the world. Here enters another complicating factor, in that within such territory through the year there is about twice as much milk produced as is consumed in the cities in the fluid form. If monthly production were uniform in quantity, the problem would be less complicated; but in the territory, as a whole, during some years about 40 per cent of the year's production appears in three of the high-producing months, while during the low-producing months the volume of surplus is comparatively small, there being a gradually lengthening period in each year when milk must be diverted to the cities from manufacturing plants. From this it will be seen that much of the one-half of the milk annually produced that is manufactured must be produced and handled in accordance with the sanitary requirements of the board of health, thus again increasing the cost of producing the milk that enters such manufacturing plants, while the manufactured products, be it butter, cheese, evaporated milk, or powder, must, by such manufacturers, be sold in competition with these products made in other regions where production costs are much less.

All of these, and other factors that I will not take time to explain, made it imperative that a method should be devised by which milk used for consumption in the fluid form should bear a price fairly related to the cost of producing it, while milk sold to manufacturers must be on a price basis that would permit them to compete with others, therefore the "pooling plan" became imperative, and by it the association can now name to all buyers one price for milk that enters the cities, another price for that entering manufacturing plants, while by the pooling of the proceeds no member is discriminated against, since it is immaterial to all members whether their milk enters manufacturing plants or the higher price city markets. By this plan, farmers delivering milk to manufacturing plants participate in the benefit of the city markets, while those whose milk enters such markets, share their proportionate part of the burden of the manufactured surplus.

As this meeting must soon close, I will close this discussion, thanking you for your very courteous attention.

Chairman WILLITS. I am very sorry, indeed, to limit Judge Miller. We have three other papers on the list, but I don't believe any of the gentlemen are here. These papers will be read by title and will be published in the proceedings.

Mr. G. DALLAS. I have been asked to read the last paper.

Chairman WILLITS. I have the honor of introducing to you Mr. Dallas, of London, who will speak on "Milk collection, treatment, and distribution in the industrial cooperative movement of England," on behalf of Mr. A. Park and Mr. R. W. Royle.

Mr. DALLAS. I want to say the English Cooperative Wholesale Society, of which I am to speak, is a society created, in the first instance, by the Rochdale type of retail cooperative societies. There is no town in Great Britain of any size and no city in Great Britain which has not a retail cooperative society, and the retail cooperative societies have thousands of members in every city. These societies have in turn created a wholesale society. This wholesale society has world-wide ramifications. It owns thousands of acres of land in Canada. It owns thousands of acres of tea plantations in China and Ceylon, large bacon factories in Denmark, in Great Britain, factories of every description, flour mills, textile mills, clothing factories, soap factories, for every product that people need in order to live. The milk department is only one of their departments, and I am asked to read the paper because the representatives of the society can not be here.

MILK COLLECTION, TREATMENT, AND DISTRIBUTION IN THE INDUSTRIAL COOPERATIVE MOVEMENT OF ENGLAND.

ALBERT PARK, manager, milk department, northern area, and ROBERT W. ROYLE, traffic manager, English Cooperative Wholesale Society, Manchester.

In drawing up this paper we are dealing chiefly with the milk department as governed by the English Cooperative Wholesale Society, although reference is made in general terms to a portion of the distributive side of the movement, under the heading of "Distribution."

Our principal system of milk collection is by motor lorries working from our various milk depots within a radius of approximately 5 to 10 miles.

Empty 10-gallon churns, thoroughly cleaned and sterilized, are delivered direct to the farms or the roadside stand erected for such purposes, the full cans being collected by the same vehicle or vehicles and conveyed direct to the dairy.

Great care is exercised in the direction of seeing that the radius covered shall be as limited as possible, so that the minimum of time shall elapse between the time of milking and receipt in the depot. Further, we also endeavor to work to a time-table as far as possible, in order to insure that milk shall not stand on any given platform, or at the farms, an undue length of time, and if the farmer does not conform strictly to this time-table he runs the risk of not having his milk collected.

TREATMENT.

On arrival at the depot all milk is tested for acidity, after which it passes through an extensive and scientific process in order to insure that it shall be thoroughly clean, pure, and of the highest hygienic value. Up to the present at our depots milk is treated by the " flash " process of Pasteurization, thus raising the temperature to approximately 170° F., then is passed over a cooler and reduced to approximately 30° to 32° F. (Whilst there may be differences of opinion, even amongst expert dairymen, as to the wisdom, or otherwise, of the " flash " system referred to, it is more than likely that before the end of the year we shall have adapted ourselves to the " positive " or " holder " process, in order to conform to the requirements of the new Government order, and thus be able to continue the sale of Pasteurized milk.)

We have in operation a fairly elaborate system of index cards showing the continual daily records of farmers' tests for fats, dirt, etc., thus enabling us at any time to turn to a farmer's record under any of these heads for any given period.

In addition to this, we also make tests of every consignment of milk leaving the depot to distributive societies, both for fats and dirt, in order to safeguard ourselves against the possibility of prosecution through the milk being tampered with in the course of transit.

From the depot the milk is largely transported by rail, although in some cases, within a given reasonable distance, it has been found possible to transport by road more economically, and with a greater degree of satisfaction than by rail.

In the past the English railway companies generally have not given the attention to the provision of suitable vehicles for the transportation of milk which is requisite; as a matter of fact, it has been found no uncommon thing for milk to be transported in vans previously containing fish, and anyone in the business must know there is nothing so subject to collect either taste or smell as milk. Again, we have at times to contend with open railway wagons, without even sheets to protect the cans from the sun and dirt. The recent parliamentary report confirms this experience, and we believe the various railway companies will be compelled by force of circumstances to change their transport methods of this commodity in the near future. Road transport is in certain areas within the vicinity of large towns assisting in bringing about the change.

A food such as milk calls for the highest possible efficiency. Insulated railway vans should be provided. If this latter was an accomplished fact the country would undoubtedly be saved a tremendous amount of money when a period of hot weather is experienced. The loss to-day by souring, in consequence of the failure to provide the proper transport vehicles, is sometimes most appalling. This loss, it must be remembered, has all to be borne by the general public.

Where milk is conveyed by road, delivery is made direct to the cool chambers of the distributive societies, but when consigned by rail the milk will probably arrive at the destination station in the early hours of the morning, and has thus to stand some considerable time at the railway station awaiting collection by distributive societies. Thus it will be seen that there is a likelihood of the milk being in a less fresh condition, having to stand out in the open and running the risk of being tampered with, than when conveyed by road as in the case just mentioned.

DISTRIBUTION.

The Cooperative Wholesale Society, having so far collected the milk from the farmers and passed it through the depots in the manner stated, it is then passed on to the distributive societies for sale to the members.

Here, now, we come across one of the best features of cooperation, i. e., the elimination of the problem of overlapping. Through the medium of the Cooperative Union of Great Britain the whole of England and Wales is mapped out in areas operated by the various distributive societies. Each one sells his goods in a given area; and each one being a distinct entity, the method peculiarly suitable to the district operated is adopted. Thus it will be gathered that with each distributive society organizing its own system of milk distribution, these are many and varied, but undoubtedly they have proved a success, and the trade in milk by cooperative societies is gradually increasing throughout the country.

To illustrate this point we give examples of three different methods of distribution obtaining with cooperative societies:

No. 1 is a society situated in a town with approximately 130,000 population; the number of members just under 40,000, and employees 1,400. This society commenced retailing milk in its raw state at the close of 1904 within the limits of its own dairy. Ten years later delivery was extended to three villages with a total population of 5,500, quite near to where the society's dairy is situated. With the exception of 250 gallons per day from the society's own herd, the whole of the milk is bought from some 90 producers, such farms being within a radius of 6 miles round the dairy, and the present supply is approximately 4,500 imperial gallons daily.

The society finds cans, and collects from 60 of the farmers, at a charge of 1 penny per gallon, and the remainder delivers direct to the society's dairy, and receives the full contract price agreed upon between the farmers and the society at a meeting called specially for the purpose.

The average monthly delivery from each farm during the months of November, December, January, and February, with 10 per cent added, is the quantity to be paid for at a full price during the six summer months. The surplus is paid for at a price agreed upon for manufacturing purposes.

The dairy and plant are situated 3 miles from the center of the town, and were erected at a cost of £8,000. Here the milk is cleaned, Pasteurized, and cooled prior to being put into cold store until the following day. Milk required for retail trade is conveyed by motor from the dairy to the depots in the borough, and given out to roundsmen (milk sellers with hand barrows) for distribution to customers. Each man has a district allotted to him, and is not allowed to sell in any other district. The extreme borders of the town are served by four horses and floats in charge of men whose headquarters are at the dairy, from where they obtain their supply of milk direct. After serving their customers, the aforesaid horses and floats call at the town depots and collect any surplus returns from the barrowmen, and return to the dairy. These men are paid trade-union rates of wages, and a commission of one-quarter penny per gallon on all milk sold. Their average sale is about 5 per cent of the total milk sold, thus leaving 95 per cent distributed by barrows in charge of 75 men and 10 women, on a commission basis. In pre-war days the commission was 1½ pence per gallon on all milk sold (females paid the same as males), but during the war the commission was advanced to 3¼ pence per gallon, and at present it is 2¾ pence per gallon. The men in charge of the horses and floats work 48 hours in the seven days. It should be specially noted that milk is delivered only once in each day.

When the roundsman is receiving payment for milk, a check, or receipt, is made out in the presence of the customer, showing the member's share number, also the roundsman's number, and the progressive number of each check made in the roundsman's book, as well as the amount paid. In addition to the check given to customer, there are two carbon copies left in the book, and these must be returned, with cash, to the society's office, for purpose of checking cash and posting the amounts spent on milk by each member.

In the first full year, 1905, the average number of gallons sold per roundsman per day was not more than 15. After the first 5 years this average had increased to 25 gallons; at the end of 10 years the average was 30 gallons, whilst at the end of 1922 the average was 36 gallons.

During the months of May and June, when milk is at its highest point, an average of 40 gallons is reached, without any extension of the time worked by the roundsman over and above that of 1905. This result has been obtained by increasing customers in the same street, until in some cases full work is found for a roundsman in one street only; others there are who serve two streets only, which adjoin each other.

The following are the amounts bought and retailed each year, with purchase and retail prices per imperial gallon. Surplus milk is made into either butter or cheese, and in some cases sold to neighboring cooperative societies engaged in retailing milk. All expenses incurred in converting surplus between purchase and retail amounts are included in the following:

Year.	Bought.	Price paid.	Retailed.	Price received.
	Gallons.	*d.*	*Gallons.*	*d.*
1905	65,780	6.50	45,580	12.00
1906	73,358	6.50	58,687	12.00
1907	95,600	6.83	76,482	12.00
1908	134,150	6.87	107,320	12.00
1909	193,858	6.91	145,424	12.00
1010	311,790	7.04	212,342	12.00
1911	393,652	8.37	282,518	13.00
1912	512,145	8.68	365,304	12.66
1913	613,213	8.35	469,595	13.00
1914	746,612	8.25	556,533	13.00
1915	811,380	9.58	607,271	14.50
1916	785,596	12.45	627,445	18.00
1917	801,817	15.50	729,531	21.33
1918	831,029	20.50	797,217	26.83
1919	946,802	25.00	852,307	31.79
1920	1,052,900	26.41	966,211	34.33
1921	1,222,283	21.16	1,068,356	30.16
1922	1,370,257	14.58	1,209,772	22.33

The average total cost per imperial gallon in wages and commission during the 10 years ended December, 1922, works out at 2.71 pence on all milk purchased. The average total expense per imperial gallon which includes charges for interest on capital, depreciation on buildings and plant, renewal of utensils, as well as overhead charges, works out at 1.33 pence on milk purchased, leaving an average profit (or surplus) for 10 years of 2 pence per gallon, which was returned to members as dividend on their milk purchases.

No. 2 society has a membership of 15,000 and is nothing like so compact as No. 1.

The distance across its field of operation from point to point is probably 8 miles, and the milk depot is situated some 5 miles away from the railway station, to which all its milk is consigned.

This means that all supplies have to be collected by motor and taken to the central depot for treatment, after which it is placed in cold stores until the following morning.

This society has 15 dairy carts, and each cart disposes of approximately 60 gallons daily. It therefore follows that, working with the maximum of trade and the minimum of expense, they have been able to maintain a satisfactory profit for many years, despite the severe handicap they labor under, in being so far removed from a railway station.

No. 3 society collects all of its supplies by own conveyance from the Cooperative Wholesale Society depot in the country, a distance of about 8 miles. It has 19 grocery branches, each of which acts as a distributing center, and the members have to go to their nearest branch for supplies. This necessitates the grocery branches being opened on Sunday, and the shopman who works on Sunday has the privilege of playing the Saturday afternoon following; this arrangement is found to be very acceptable to the staff.

The system of distribution enables the society to retail milk generally 1 penny per quart cheaper than the competitive trader, and up to the present it has proved successful.

Since they began to retail milk in April, 1922, their sales have more than doubled; the first week they sold 1,172 gallons, while the trade has now reached an average of 2,600 gallons weekly.

Not all the distributive cooperative societies have as yet ventured into milk selling, but gradually, as success is heard of in the various centers, societies are more and more considering the advantages to be derived from such business, and members of the local distributive societies in turn are pressing their buyers and managers to retail milk to the members. We are optimistic enough to believe that there is as great a feature in cooperation in the distribution of milk as has been proved to be the case in the distribution of dry goods, etc., meaning, as the experiences quoted above prove, cheaper methods of distribution, and a saving to the consumer.

(Adjournment.)

(Papers read by title):

THE COOPERATIVE MILK PLANT IN THE SMALL CITY.

LEE BRIGGS COOK, manager, Dairymen's Association of Beaver, Pa.

In this paper on small cooperative milk plants I wish to call your attention, in a general way, to some of the successes of these organizations, and to emphasize some of the failures that I have noted, so that anyone interested in forming such organizations can correct these errors at the beginning, as I believe they can be corrected to a large extent before they cause detrimental results.

During recent years, considerable interest has been aroused in the United States in regard to cooperative enterprises for farmers. The unsettled condition in regard to prices received for farm products has gradually increased the interest along this line. Among the organizations that have arisen have been cooperative milk plants, on both large and small scale. This paper, however, is limited to a discussion of the small organizations, some of which are strictly cooperative, others not, but for the most part are wholly controlled by farmers. These small plants have been located in rather small communities, generally less than 50,000 population, and in many cases less than 15,000. These plants have been sponsored largely by the State agricultural colleges and the local agricultural agents. Interest has been aroused in communities where an all-year market for milk does not exist, and where as a rule safe Pasteurized milk is not sold, as a good market and a safe milk supply are two of the main purposes of such organizations.

The arguments for organizing these plants have been many, and possibly in some cases some of the advantages have have overestimated, but one of the main factors has been to start a plant that can and will handle all the milk produced by the members throughout the year. Of course, at times, this means that some of the milk must be handled as surplus and made into cottage cheese, butter, etc.

These plants have cut down the city delivery expense by eliminating many of the existing routes, and centralizing delivery from one point. One of the important points when organizing these plants is to get as many as possible of the local farmer dealers to join, and sell their routes to the organization. This gives routes and trade to start business, and eliminate some of the competition. One thing that has done much to give these plants a poor start and a bad start is their failure to realize the importance of a qualified manager. The management is a big factor with any organization. Most of the plants in Pennsylvania, where I have received much of my information, have had two or three different managers during the first year, and as a rule have gone from bad to worse until the directors have awakened to realize that a trained manager at a good salary was a necessity. In many cases, when these plants are organized, with their 50 or fewer, members, some one among the number feels himself qualified to become manager of the plant. He applies for the position at a moderate salary, and because of his personal acquaintance and the low salary such a person is altogether too often hired for the position, with the detrimental effect that the plant struggles along without any real growth of business, but with a growth of bad criticism, until finally a change has to be made. If these organizations could only realize that to have a qualified manager, taking full charge of the company's business, is the cheapest policy in the final result, many of these plants could turn their losses into gains. To these small farmer-controlled plants a salary of $300 to $500 per month for a manager seems altogether too much for them to pay, but later because of real necessity many have come to realize the truth of this argument.

I believe I am safe in saying that when these plants are properly operated they give the people of the community a better and safer milk. This, in small communities, is a view that is not universally accepted, as many people have not been educated to Pasteurized milk and are slow in believing that milk not delivered by a farmer in an old rickety wagon is as good. On the other hand, these plants usually carry a sufficient supply of milk and dairy products so that customers soon know that extras can be purchased; consequently I am sure that they have a tendency to increase the consumption of milk and dairy products.

In these small communities, as a rule, no milk ordinance is in force and no one is paid to enforce health measures, consequently the dairy plant putting out safe Pasteurized milk in competition with the old-time farmer has a rather slow and unappreciated business. In time, of course, the people begin to see the value of the plant and its products, and I am sure that the majority of them would not want these small plants to cease operations. These plants, no matter how small, help to improve the community by doing a business with most of the money circulated in the local community.

The advantage to be derived from such small organizations is oftentimes overrated at the beginning, which means that some of the members soon become dissatisfied and either go out of the dairy business or else break their contracts. Although at the beginning these contracts with the members seem to be strong and binding, usually on a test they are found wanting and not enforceable. Possibly the directors do not have the desire to enforce the contract, because of neighborly feelings, blood relationship, or some other factor that should not enter into such transactions. Lack of real business methods by the members or directors is always curtailing the growth and usefulness of the plants. I believe that when a dependable manager has been secured for the work he should be given full charge of the business, to handle it without favors to any member, and that directors should have regular meetings only once or twice each year. Usually they meet at least once a month, which creates a tendency for them to try to solve the manager's problems, and they become too closely interested in the details of the plant and its operation.

Usually some of the members do not want sanitary rules enforced in regard to their product, which is a handicap to the work of the manager and to the best interest of the products handled by the plant. The only way I see of overcoming this matter is for the manager to have full power to make and enforce rules or refuse the milk. Ofttimes members feel that because they own stock in the company the plant must take their product in whatever condition they deliver it. This limits the manager in making final decisions in such matters and is a handicap to the growth and prosperity of these small dairy organizations.

When these plants are started, oftentimes the price that members will receive for their milk is overestimated, and when the price does not reach the standard expected some become very dissatisfied. Farmers often seem to forget that the rule of supply and demand must govern prices at all times. Also they fail to realize that it costs something to operate a business of any kind. With the detrimental start that many of these plants have had, the price paid the farmer has oftentimes been as low as, or lower than, the standard market price for the community; though later, when the plant is operating satisfactorily, a better price is paid. Many fail to realize the value of the difference in time consumed, when one delivers milk in cans to one central point, against house-to-house retail delivery. If the dairyman is a real dairyman he should consider his time of value; evidently some seem to think that peddling milk all day does not cost anything. In our little community I know of a considerable number of farmers who are peddling less than 20 gallons of milk per day and taking most of the day to do it, or else keeping a hired man for that purpose.

Many of these small cooperative plants have been able throughout all of their ups and downs to pay the farmer as much for his milk as the standard local price, or even more. At our plant in Beaver, Pa., we are governed by the price set for the Pittsburgh district, and we have been able to pay our members from 20 to 40 per cent above this set price. Also, the value of the plant, equipment, etc., has increased so that the business could not be purchased for near the original investment. This in time will mean a return to the members, and should be considered when one studies the real value of these organizations. Six per cent interest is usually paid on the stock. With the 6 per cent and the added valuations these plants should be considered a good investment from a purely financial standpoint, to say nothing about the all-year market for all milk produced, and the added price paid, if any.

Very few of these plants have grown in volume of business as might be desired. This is due, first, to poor management, and, later, to the limited size of the community and the amount of small competition. It is doubtful if many of them will grow much larger than they are at present, if they have been in successful operation for two or three years. However, the business becomes stable, and expenses, operations, etc., become adjusted to the situation; therefore the farmer is usually as well off in the organization as out of it, if not better.

Some of these plants can take up new lines of work, and thus increase their usefulness to the community and the farmer. Some plants buy feed, fertilizer, etc., for the dairymen. Others make ice cream, chocolate milk drinks, buttermilk, etc., as added methods of handling the surplus milk. The amount of surplus necessary for these plants to handle is a big factor in determining the price that can be paid the farmer. All must handle a certain amount of surplus in the spring of the year.

A store to handle milk, cream, dairy products, eggs, etc., can often be operated at a profit, as many people like to buy extras, and, buying at a farmer-controlled store, they feel they are securing good, fresh products. If the plant is not located so that a store can be operated at the main office, oftentimes enough business can be secured to justify renting space for this purpose. In Beaver we are located on the main street and in the heart of the business section, so we operate a store at our plant without any real additional cost. Our store, located in a small city of 4,000 to 5,000 population, averages about $50 sales per day. A considerable amount of this trade is from customers who buy regularly from our competitors, but buy extras at our store.

Cooperation, according to Webster's Dictionary, means "to operate jointly with others"; according to everyday practice with a small farmer's organization, the meaning is quite different. The joint operation ceases very easily if conditions and prices are not satisfactory. In theory cooperation is a fine idea. It is a great subject to talk and write about; but when it comes to organizations where each member feels it his duty individually to operate the business, the actual working of real cooperation is not so easily accomplished.

These small cooperative dairy organizations have failed to accomplish so much as they might, because of allowing dissatisfied members to break their agreements, because of the limited size of the community, the large amount of competition, failure to appreciate the value of a good manager, and lack of real business methods. On the other hand, they have accomplished a great deal. Plants which have started on a small amount of capital have increased their valuation; they have given the people of the community better, safer, and more abundant supplies of milk and dairy products; they have kept the prevailing retail prices standardized; they have paid the farmer as much, or more, for his products as other markets, and handled his surplus milk; and have had a general uplifting influence on both producer and consumer for better and safer milk and dairy products. Therefore as a general proposition I consider that the small cooperative plants I know have been a success, although not so great a success as they might have been. Thousands of dollars have been lost that should have been returned to the members as profits; yet withal, they have been a financial and sanitary benefit.

COOPERATION AS APPLIED TO THE DAIRY INDUSTRY IN ENGLAND.

The Right Hon. FRANCIS D. ACLAND, M. P., chairman of the English Agricultural Organization Society, London.

In considering questions affecting the organization of the dairy industry in England, whether on cooperative or other lines, it must be borne in mind that the sale of milk in liquid form for human consumption represents the most profitable outlet at the disposal of the dairy farmer.

Cooperative organization, therefore, aims, in the first place, at placing the milk supplied by its members at the disposal of the consuming public in the large centers of population with as little delay as possible after leaving the farm and in the best condition for keeping.

If the conditions for milking at the farm, and for transport from farm to consuming center, were ideal, undoubtedly the best plan would be for all milk for human consumption to travel direct from the farm to the consuming center, and for only such surplus milk as was not required for human consumption to be handled at the country depots and converted into dairy by-products.

Unfortunately, save in few cases, these conditions do not prevail, and the milk must be cleansed, cooled, and, in many cases, Pasteurized before it is sold for human consumption.

The general line of cooperative organization has been, therefore, for the united farmers of a dairying district to erect a local milk depot equipped to clean, cool, and Pasteurize milk, with additional plant for converting surplus milk into some by-product, such as cheese, butter, or milk powder. The practice is for the farmers to combine on cooperative lines and to find the capital necessary to erect the depots and plant and supply the required working capital. The general method adopted is for the farmers' cooperative society to undertake the disposal of its members' produce, returning to them the prices realized less cost of handling. When making these payments the proportion of milk converted into butter and cheese during the period is ascertained, and members are paid for so much milk at whole-milk prices and so much at the lower price reigning for milk for manufacturing purposes, in accordance with the ascertained proportion. This method of payment is adopted irrespective as to whether the milk of any producer has all been used as whole milk, as the keeping of surplus milk off the whole-milk market benefits all milk producers. Within this general scheme of payment, it is, of course, possible to regulate payment according to quality, either on a butterfat basis or otherwise.

As cooperative societies are faced with severe competition from large joint-stock enterprises anxious to secure the control of the milk of any given district, there has at times been a tendency on the part of some cooperative societies to allow themselves to be forced into the position of buying their members' milk outright at unremunerative, competitive prices. At this form of competition the joint-stock concern with its greater capital resources invariably comes off best, and those societies which have indulged in it have invariably had reason to regret their action.

A cooperative society having been established and properly equipped both as regards plant and capital, on what does its success depend? I think the main essentials of success may be enumerated in the following order of importance:

1. The general adoption of the cooperative principle in the district.
2. Guaranty of supplies.
3. Reliable outlets.
4. Capable management.
5. Provision for increased capital as the business grows.

I will deal with these main points in order.

THE GENERAL ADOPTION OF THE COOPERATIVE PRINCIPLE IN THE DISTRICT.

As the ultimate success of cooperative working depends for its complete success on the whole-hearted combination of those interested in the particular branch of the industry concerned, it is of little use for a small section of the dairy farmers of a particular district to combine if the other farmers of the district continue to support the trade competitors. Competition keeps down prices and overhead charges remain too high in proportion to turnover.

GUARANTY OF SUPPLIES.

Individualism and a love of freedom of contract are marked characteristics of the English farmer, and even when he gives his adherence to cooperative principles he is rarely prepared to surrender whole-heartedly his freedom of action as a seller in the interests of the success of his society. Yet no society can be a complete success or do its best for its members unless it can rely on their unswerving loyalty. Committees of societies have been reluctant in the past to enforce on their members as a condition of membership a contract agreement for supplies of milk covering a period of several years. Experience has shown, however, that it is useless to depend entirely on loyalty, and some definite long-period contract is absolutely essential. The problem, however, is not an easy one as, unless these contracts are very carefully drawn up to meet the particular circumstances of each case, it may be difficult, in the event of their repudiation, to enforce their conditions in a court of law. It is in this direction, nevertheless, that the solution of the problem of regular supplies is to be found.

RELIABLE OUTLETS.

In considering the question of outlets for the milk of cooperative dairy societies, it is necessary to refer to the general conditions of milk distribution in England to-day.

The enormous expansion of our industrial areas, with their ever-increasing populations, whilst greatly increasing the consumption of milk and dairy products, has pushed farther and farther away the areas from which the milk is drawn so that, save in certain provincial areas, it is not possible for a farmers' dairy society to supply the consumer direct, nor is it always possible, where large quantities of milk are handled, to deal directly with retailers, though every effort is made to avoid sales through wholesalers.

A farmers' society generally aims at building up a connection with retailers in a few convenient markets and so securing a constant outlet for the bulk of the milk it handles, reducing surplus for conversion into butter or cheese to a minimum.

Some societies confine their operations to arranging contracts for the sale of whole milk on behalf of their members, charging a small overriding commission for their services, the milk going direct from the producer to the retailers. These societies only handle surplus milk through their depots.

The bulk of the milk consumed in our large towns must be cooled, cleaned, and possibly Pasteurized before it reaches the retailer, and must, therefore, pass through a depot either at the producing or receiving end, or both. These depots are also depended upon for regular supplies.

It is contended by some that the treatment of whole milk, the regulating of supplies, and the conversion of surplus is best dealt with at the receiving end, where the demand can be more accurately determined. One argument in favor of this contention is that in the case of milk to be sold as Pasteurized on which a high bacterial standard is to rule, it would not be possible to insure that milk Pasteurized in the country, owing to conditions of transport, could be maintained at the requisite standard without re-Pasteurization at the receiving end.

On the other hand, the country depot is the natural place for regulating a highly perishable product subject to deterioration during transit, and the by-product produced in the country from the fresher milk should command a higher price. Also, the sooner milk is treated after leaving the farm the better, if quality is to be maintained.

Whilst the country depot system remains in force the farmers in combination can, by acting as their own wholesalers, retain for themselves both the producer's price and the wholesaler's margin. If treatment at the receiving end must be resorted to, the farmers' society must either sell to a wholesaler or next town depot which will be far removed from the center of control.

From the standpoint of obtaining for the farmer a maximum proportion of the difference between the producer's price and the price paid by the consumer, the best method of milk disposal is through retail shops owned by the farmers' cooperative society, but the acquisition of outlets of this nature for large quantities of milk involves heavy capital outlay which farmers to-day are not in a position to find. Societies operating in a small way in a provincial center have made a distinct success of this method of working, but the question of capital limits its wide extension.

CAPABLE MANAGEMENT.

The question of management is always an acute one in connection with any farmers' cooperative society. Speaking generally, farmers have not had that commercial experience to make them appreciate the real economy of paying a high salary to secure a really first-class manager. They fail to realize that the really competent man can save his salary three or four times over.

In the case of several societies, where a promising man at a moderate salary has developed into a first-class manager, he has been lost to the movement through being attracted to the competing trader by the offer of much higher remuneration.

For success, a society in a large way of business must employ not only a first-class factory manager but also a tiptop salesman, and these qualifications must be paid for.

Another weakness in respect of management is the loose control often exercised over the finances of the society by the committee of management. Societies are frequently short of capital. Bank overdrafts are allowed to take the place of permanent capital, and insufficient effort is made to bring home to members the necessity of providing their society with sufficient capital.

PROVISION FOR INCREASED CAPITAL AS THE BUSINESS GROWS.

When an active propaganda is conducted in connection with the formation of a dairy cooperative society, enthusiasm may be aroused and sufficient capital raised from the farmers to build and equip the depot and start the society on sound lines. But, if well conducted, the business grows and requires even more capital. Amongst new members there is always a tendency to seek membership on the minimum basis of shareholding, and this minimum is generally quite insufficient to carry the capital requirements of the new members' business. In some cases the difficulty is met to a certain extent by making the shareholding basis dependent on the number of cows milked, but even then there is the limitation of £200 of shares as fixed by the industrial and provident societies acts under which cooperative societies are registered. There is the further point raised, though not finally adjudicated, in a recent case in the high court as to whether a fluctuating liability in respect of share capital does not infringe the principle of limited liability.

Experience shows that it is desirable in connection with the formation of a cooperative dairy society to fix the nominal value of the shares at a high figure, say £10 or £20, but to leave a considerable portion of each share uncalled in the first place, calls being made as the business expands. Also to fix the shareholding qualification at a figure which will insure that each member bears his fair share toward capitalizing the business his society undertakes for him. No milk should be accepted from nonmembers.

Having outlined the general nature of the English cooperative dairy societies and the conditions on which their successful working depends, I will give some figures as to their operations.

At the end of 1921 (the last period for which complete statistics are available) there were in England 41 cooperative dairy societies affiliated to the Agricultural Organization Society, representing a total membership of 9,228 and a turnover in respect of sale of milk and dairy produce of £2,736,198. This figure represents, it must be admitted, but a small proportion of the value of the estimated milk production of England—some 900,000,000 gallons—but as the societies are situated in many of the principal dairy counties their operations are sufficient to appreciably affect the price received by the producer, who would otherwise be entirely dependent for his outlet on the joint-stock wholesale concerns.

The influence of the movement would be still greater if the societies, instead of working as individual units, would form a central federation for controlling sales. At the present time societies are actually competing against one another in respect of selling outlets. It has been possible, by means of conferences, to adjust minor difficulties and secure united action in regard to certain matters affecting the cooperative dairy movement as a whole, but if full success is to be attained more than this is required. A central trading federation exercising control over its units, the societies, and handling their products in bulk must sooner or later be established.

The agricultural cooperative movement has received considerable assistance from the Government in the form of grants from the development fund to the central organizing body, the Agricultural Organization Society, and, in addition, a few societies, as a special measure during the war, were granted loans to assist them in the erection of plants.

All Government assistance has now ceased, and for carrying on further propaganda and organizing work the Agricultural Organization Society will be dependent entirely on voluntary income. As it is difficult to bring societies up to the pitch of finding funds for work which will not immediately benefit them, the prospects of any general extension of the movement are not bright.

Two important Government committees, the agricultural tribunal and the departmental committee on distribution and prices of agricultural produce, have both reported in favor of an extension of the cooperative dairy movement.

The agricultural tribunal, in paragraph 33 of its report, says:

> There is, however, a much larger question in connection with milk production in this country. There is evidence of a considerable increase in the number and extent of operations of farmers engaged in the production and supply of fresh milk. As a result there tends to be a recurring crisis, due to overproduction of milk, particularly in summer, and resulting in considerable loss through wastage or uneconomical use of milk. The remedy for this lies in the erection by associations of farmers or by companies who purchase their milk, of milk-collecting depots at local centers, equipped with plant for the proper treatment of the milk before railing, and for the conversion of the surplus milk into dried or preserved milk, butter or cheese. These societies are of great economic value, assisting payment by quality, economy in collection, and treatment of surplus milk, while the by-products can be used locally for stock feeding. The advantage of such depots, with the necessary equipment for converting surplus milk, has been fully demonstrated in foreign and colonial experience, while in recent years the development of such depots in Scotland has been of much benefit to the dairy farmer. We are of opinion that the State should actively encourage the formation of such societies or companies—advancing loans to assist in the erection of the necessary plant, as has been done in Scotland. Further, in the interests both of the farmers and of the food of the community, an active propaganda should be carried on to increase the consumption of milk, as has been done with most marked success in recent years in the United States.

The departmental committee on distribution and prices, after referring to the comparative failure of some of the English cooperative dairying societies and enumerating some of the main difficulties which they have had to face, says:

> The lack of success of cooperative dairying in England should not, in our opinion, be allowed to prejudice its future development on sound lines and in suitable areas. The causes of failure, which have been pointed out, can be largely avoided and, as is shown by the success attained in Scotland, they are not inherent in the system .
>
> Each case needs consideration on its merits, but, in our opinion, the essentials to success are briefly:
>
> (1) Competent management, which, in the case of a society of any size, means the payment of adequate salaries. In the case of small societies, successful results may sometimes be obtained by voluntary assistance.
>
> (2) The acceptance of the true cooperative principle of marketing the produce on behalf of members rather than buying milk outright from them.
>
> (3) The recognition by the members of an obligation to support and maintain the society in the face of outside competition, and the expression of this obligation by means of firm and legally enforceable contracts to supply milk for a fixed period.
>
> (4) The combination of societies into a federation for the protection of their mutual interests, for assistance in the sale of products, and in particular for the prevention of competition and overlapping among the societies themselves.
>
> There are also considerable advantages in placing the depots of cooperative societies adjacent to railway stations in order to assist in the collection, bulking, and forwarding of produce. Certain cooperative societies also follow the practice of adjusting prices to milk-producers by butterfat content, and this is held to be an incentive to the improvement of the standard of production. So long as the National Farmers' Union is able to make satisfactory agreements with buyers, whereby these buyers take the whole of the milk produced

and thus assume responsibility at the expense of the consumer for dealing with the excess which can not be sold for liquid consumption, farmers may not think it worth while to cooperate, but we regard it as a question to which the National Farmers' Union would be well advised to give serious consideration with a view to encouraging the formation of cooperative dairy societies under suitable conditions and in districts where they are most needed and likely to achieve a fair measure of success.

Where difficulties exist in the direction of obtaining sufficient capital from farmers themselves, or from other private sources, we consider that the Government's proposal to stimulate the formation of cooperative credit societies in rural areas and to advance to such societies 1 pound for each pound of capital subscribed by members, of which a sum of not less than 5 shillings in the pound has been paid up, would, if made applicable, go far to meet any financial difficulties that may stand in the way of a considerable expansion of cooperative dairying, particularly in remote and isolated districts where it may be most needed. We also consider that the funds available under the trade facilities act might be utilized with advantage, and we suggest that the trade facilities act advisory committee should give favorable consideration to applications from suitable associations of farmers for assistance in the development of the dairying industry.

It now remains to be seen what practical steps the Government will take in order to carry out the recommendations made by these committees, which recommendations have been indorsed by the National Farmers' Union.

COOPERATIVE MILK DISTRIBUTION.

HARRY HARTKE, member of executive committee, the Cooperative Pure Milk Association, Covington, Ky.

The Cooperative Pure Milk Association is organized under the State laws of Ohio, with 2,950 active members, living in southwestern Ohio, southeastern Indiana, and northern Kentucky, who supply Cincinnati and the adjoining markets. It is the outgrowth of an old bargaining association, known as the Queen City Milk Producers' Association, which was not incorporated, was a voluntary organization with no contract with its members, and whose primary function was to meet the dealers at frequent intervals during the year and attempt to secure a satisfactory price for the farmer's milk.

The Queen City organization during the war did very effective work and was well supported by the farmers. However, due to the opposition of the dealers and the poor system of financing, which was on a basis of 50 cents per cow that each member owned or controlled, there developed a great deal of sentiment for a more closely united organization that demanded of its membership a contract and certain financial obligations.

For a long time the leaders in the old Queen City bargaining association, on account of lack of information and existing laws, resisted the growing demand of the members to reorganize on the pooling plan. At last the demand from the membership became so strong that the president was asked by unanimous vote to select a committee to work out a marketing plan. The committee selected, of which I had the honor of being a member, investigated for an entire year conditions throughout the country and then called into consultation the recognized cooperative dairy experts from all sections, who recommended this plan to the local chairman and officers of the old Queen City association. The plan was next presented to all the members, and they unanimously approved the plan; not until then was anyone asked or allowed to sign a contract. In order to attain success we recognized a binding contract signed by a sufficient number of producers controlling over 50 per cent of the milk was necessary, and if we were to take over any of the activities of the existing manufactures or distributors of milk it was necessary to finance accordingly.

After carefully analyzing the financial condition of the farmer, our unanimous conclusion was that $20 a cow, as advanced capital, would be as little as would properly equip and establish plants and was as much as the farmer could subscribe, and that if they paid $20 a cow, and if we wanted as members, tenants and farmers of meager finances, it would be necessary to so arrange it that those without credit or funds could be admitted as well as those who had cash. We therefore stated as part of the conditions of becoming a member, after signing a contract, the member would sign a 30-day unconditional sight note for $20 for each cow he owned or controlled, and in the contract the member gave the association the right, on his failure to pay this note, to deduct from his monthly milk check amounts that the board of directors should determine until the note was paid. The contract also gave us the right to make additional deductions for additional capital, should it be necessary. However, I am glad to state that with the present outlook this is not going to be necessary. These notes could not be used until after 15,000 cows had been placed under contract, and then they were payable at 30 days sight. We also charged a $3 membership fee to cover the organization expenses, and I am glad to say here that we were able to get the 15,000 cows without expending in excess of the $3 per member, so that in making our investments we had no deficit to face.

We have succeeded in raising over $400,000 in notes, of which over 50 per cent had been paid in cash. The banks recognizing these notes as being 80 per cent, if not 90 per cent, collectible, offered us all the additional money necessary to pay cash for everything bought to date. So that outside of one piece of machinery and two small country plants, involving $20,000, we have no mortgages on our equipment, plants, or real estate and are holding clear title to all of it.

To-day the milk producers supplying the milk to the Cincinnati market have established four plants, two of them equipped for distributing bottled milk and manufacturing butter, condensed milk, and ice cream, and one of these plants is now distributing milk from 35 wagons to the customers in the cities of Cincinnati, Newport, and Covington.

In the beginning all of our members pledged the association that they would call on all of their friends and relatives and, in addition to this, would, at the demand of the association, put in two days' time soliciting customers for the cooperative plant. Where you have real cooperation and the proper spirit, we have found that the farmers are very effective, if not the most effective agency in securing trade.

You can imagine 2,900 farmers, and in most cases their wives and other members of the family, assisting, with the cities laid off systematically, what effect it would have on a market. We tried this method out with about 10 per cent of our membership, and we found that in some cases our members turned in as high as 30 retail customers in one day, and we were ready at the time the dealers bought our milk to put on a campaign by the entire membership.

Good will in our city for retail milk routes varies from $10 to $25 per gallon, so you can readily see the potential possibilities of an organization of farmers in acquiring the tremendous asset of good will in a very short time.

I want to say that all of this soliciting was done gratis by our members, and in a great many cases, where farmers could not solicit, they employed others or turned in a sufficient amount of money to pay solicitors for two days.

This business, which started operation in January, purchased for $8,000 good will consisting of seven retail routes. Then, with the aid of the farmers soliciting and a few paid solicitors, increased in six months to 35 distributing routes and a very desirable ice-cream and butter business. We believe this proves that the producers, when properly financed and organized, can distribute milk, and in my judgment, had the dealers not agreed to buy the cooperative milk early in July our present business would have easily been doubled.

In July the larger dealers in Cincinnati and adjoining markets agreed to purchase milk from the cooperative association, and stipulated as one of the conditions that we were not to expand beyond the present number of retail routes. However, these routes could be built up to their capacity. Nor are we now allowed to expand our ice-cream business. The dealers, in turn, agreed to purchase milk from the association and pay a 30-cent service charge on all milk which is used as fluid milk or sweet cream, and the balance, which is for manufacturing purposes, is to be sold as class 2, without a service charge.

Up to the present time the dealers have not seen fit to classify the milk, but are buying it all as class 1, and are paying a 30-cent service charge. It is also understood and agreed that if the dealers pay a higher price to any individual or association than the base price paid the cooperative, such dealer must pay the same price to the cooperative. It is also agreed and understood that the cooperative milk is class 1 milk until it has furnished a greater quantity than the market consumes. This gives the cooperative milk a preference over nonpooled milk.

Up to the present time there has been conducted by certain interests a very bitter and vicious campaign, through paid advertisements in the newspapers, attacking the cooperative organization. However, the opposition is gradually weakening, and we hope at an early date to be able to furnish all the dealers their supply. But at the present time we are satisfied with conditions, as we are able to sell all of the milk that is in our pool at a price that is equal to the Cincinnati market.

I do not believe an organization of this kind could be accomplished or is necessary in all markets, particularly where the dealers are cooperating with the organization and are willing to do business on a reasonable spread. The farmer, under ordinary conditions, would not capitalize and take the chance of conducting a business that necessarily requires expert management and a great deal of capital, if there is any other way out. But we have proven that the farmer is willing to invest his money in plants and distribute milk if necessary, and that he can do so when he is compelled to, and that there is no agency that can be capitalized nor good will attained as easily as when the farmer himself will cooperate to the extent of calling on the housewife and soliciting business for his own company and the sale of his own milk.

However, we did not organize to destroy the distributor of milk, and if we can continue to sell them our product we are glad to do so, and recognize that they are entitled to a fair profit. We also recognize that as a cooperative organization we can not guarantee our farmers a profit. We also believe that the fluid milk and sweet cream produced and consumed in our territory, and which would be difficult to ship in from long distances and maintain quality, is entitled to a profit. However, milk produced in excess of that quantity must go into manufactured products and meet world-wide competition, and if our farmers are producing an excessive quantity and the competitive markets are such as not to permit a profit, we recognize in that event we can not on a pool basis return a profit to the farmer.

We are operating our organization on the graded pooling plan, as we recognize grades that the market will absorb. For instance, if a member produces certified milk that the trade will buy as such, up to the amount that is sold as certified milk we return to the member producing such milk all that is received for the milk, less the cost of marketing and overhead. All quantities of certified milk in excess of that sold as such is placed in the common pool, and the excess amount is paid for on the common-pool basis. We also recognize lower grades than the market will consume as fluid milk, for instance, such as is only suited for butter and low-grade products. These are paid for on the lower basis.

I believe our plan and financial scheme is sound and will overcome the vicious opposition that it is meeting, and here I wish to caution the ambitious cooperators who believe in distributing and manufacturing their own products to be careful and organize in such a way as to overcome such obstacles which they are sure to meet. I will here mention a few of them: The distributors and manufacturers will most likely combine against you and will spend great sums of money to discredit you both among the farmers and the consuming public. In my experience a great many are very unscrupulous and will distort facts, make rank misrepresentation; in fact, in our particular case, our attorneys advise us that they have exceeded their legal rights, and we have entered a suit for libel against certain individuals.

If they have any influence with health departments you can be sure they will use it against you.

You will find that you can not build or construct plants as cheaply as the architects and engineers advise. Unless you are prepared to meet these conditions, better not start.

I believe proper management is the limiting factor of the progress of cooperation and absolutely essential to success. There are, however, peculiar difficulties in securing efficient cooperative management. First, few cooperatives have been in existence long enough to furnish experienced, trained managers. Old-line company managers hesitate to leave the apparent security of established concerns to begin new ventures in cooperations. Then, too, they generally lack sympathy with cooperative movements. Another difficulty is in securing trained help fast enough to meet the growth which is necessary to counteract the lack of patience and the craving for immediate success. In other words, instead of a natural normal growth we have almost an economical revolution. But with proper management the future holds little fear.

I am glad to say that on account of our investigations we recognized to a great extent what our problems would be and have tried to meet them accordingly. We found that to distribute retail milk requires an investment of $50 to $150 per gallon, and the average retail distributing plant had a turnover of two and one-half times their invested capital per year. We recognized that great sums of money would necessarily have to be spent in advertisements and in paying for certain things that would not be recognized and are not physical assets, and we did not expect to show a profit for the first year.

It is my firm conviction that the pooling plan is sound, is equitable and fair, and if the dealers will not compel the farmers to do as we have done, but will trade with them before they have made substantial investments, they will save themselves a great deal of annoyance and trouble. I believe if the dealers would give the fullest cooperation to the cooperative selling agencies of the farmers, they could eliminate certain unnecessary expenses that would be to their mutual advantage.

In my opinion, had the dealers cooperated with this organization and assisted in the collection of the small dues which would have been necessary to operate the old organization, it would have been difficult, if not impossible, to have accomplished what has been done in getting together a group of farmers supplying the major portion of the milk to a large consuming center and have them assume a minimum obligation of $20 for every cow they owned or controlled.

Our plan, outside of our original scheme of financing, is very similar to the New York Dairymen's League in that we issue a certificate of indebtedness. However, our original certificates, on account of possible need, we have made payable from 6 to 10 years, allowing the first 6 years for capitalization purposes before returning any of the money to the farmer, except interest.

I think the pooling plan has come to stay, and I believe the sooner existing agencies recognize it the better will be their opportunity to trade and the longer will be their opportunity of holding the consuming market.